

Foundation Mathematics

Unit 4

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Note to Teachers

About This Book

This book is the fourth in the Foundation Mathematics series, designed to help older students to learn to become more numerate in their daily lives; in their personal life and in work, education and community aspects of their lives. This book is broken into sections, with each linked to a content area from the Foundation Mathematics Course and the Australian Curriculum.

Planning Across the Semester

This book is designed to be used for one school semester. Some students may need to move more slowly through the content, and some might need to move faster.

The content is arranged in order and builds from one section to the next, and from one topic to the next. Therefore, it is suggested that students work through the book in the order of presentation. However, some sections could, and should be revisited throughout the semester.

The Foundation Mathematics Course

The Foundation Mathematics Course consists of the following four units. This book supports the fourth unit.

Unit One	Unit Two	Unit Three	Unit Four
1.1: Whole numbers and money	2.1: Understanding fractions and decimals	3.2: Percentages linked with fractions and decimals	4.1: Rates and ratios
1.2: Addition and subtraction with whole numbers and money	2.2: Multiplication and division with whole numbers and money	3.1: The four operations: whole numbers and money 3.3: The four operations: fractions and decimals	
1.3: Length, mass and capacity 1.4: Time	2.3: Metric relationships 2.4: Perimeter, area and volume	3.4: Location, time and temperature 3.5: Space and design	
1.5: Data, graphs and tables	2.5: The probability of everyday events		4.2: Statistics and probability
			4.3: Application of the Mathematical Thinking Process

The course is designed to support students to learn, not only the mathematics content, but the mathematical thinking and decision making processes they will need as adults. This is integrated into this book and throughout the course.

For more information about the WACE Foundation Mathematics Course and Assessment ideas go to:

<http://wace1516.scsa.wa.edu.au/mathematics/>

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Section One

Rates and Ratios



Content Focus

Foundation Mathematics

- 4.1.1 Identify common use of rates such as km/h, cents/litre, \$/kg, \$/h
- 4.1.2 Identify common use of ratios in practical situations
- 4.1.3 Determine whether an estimation or an accurate answer is needed in everyday contexts involving rates and ratios
- 4.1.4 Understand rates as relationships between two amounts in everyday contexts; for example, km/h
- 4.1.5 Use repeated addition, multiplication or division to work out simple rates, such as litres per 100 kilometres, either mentally or with a calculator
- 4.1.6 Compare rates (such as dollars per kilo) to say which is the better buy
- 4.1.7 Understand simple ratios as proportional relationships between two or more amounts
- 4.1.8 Read, write and use simple ratios as fractions, percentages or numbers separated by a colon; that is 3:1, in practical contexts
- 4.1.9 Use ratio to interpret simple scales on maps and plans
- 4.1.10 Use simple ratios to make mixtures according to directions
- 4.1.11 Use repeated addition, multiplication or division to increase or decrease amounts in practical situations involving ratios
- 4.1.12 Determine whether an answer is reasonable in situations involving rates and ratios
- 4.1.13 Communicate information (oral and written) about rates and ratio using language and symbols consistent with the context

Australian Curriculum Link

- ACMNA099 Use estimation and rounding to check the reasonableness of answers to calculations
- ACMNA121 Find unknown quantities in number sentences involving multiplication and division and identify equivalent number sentences involving multiplication and division
- ACMNA173 Recognise and solve problems involving simple ratios.
- ACMNA174 Investigate and calculate 'best buys', with and without digital technologies
- ACMNA188 Solve a range of problems involving rates and ratios, with and without digital technologies
- ACMNA208 Solve problems involving direct proportion

Topic 1

Rates

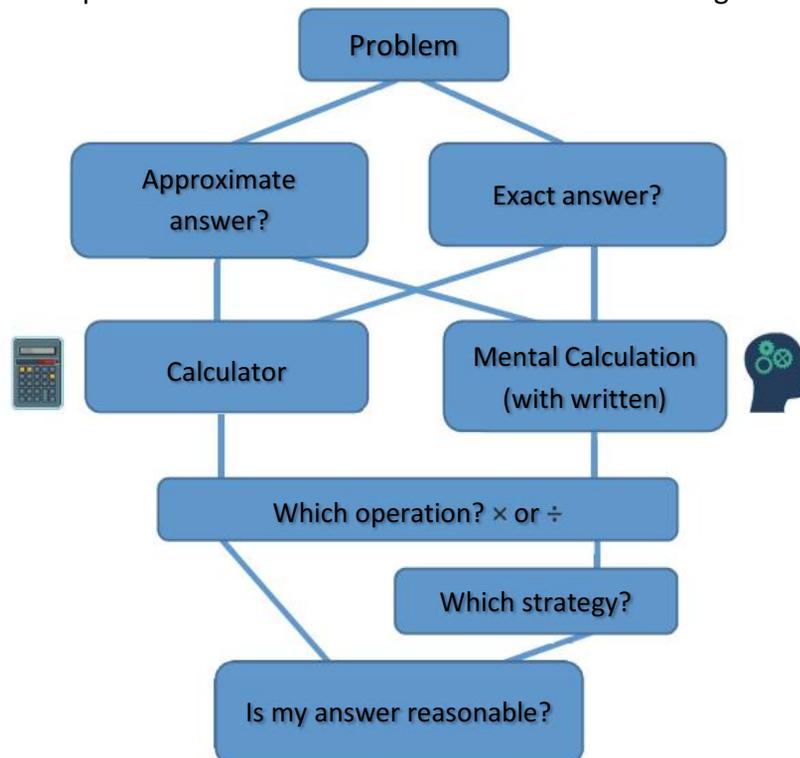
Mathematics Discussion

We often refer to rates in everyday situations when we talk about things like rates of pay, kilometres per hour, or dollars per kilogram.

A rate describes a relationship between two different units. In a rate such as 80 km/h, the two units of measure are kilometres and hours. The forward slash (/) symbol in a rate, is used to separate the two units and is read as 'per'. Thus, 80km/h is read as '80 kilometres per hour'. The number 80 denotes neither kilometres nor hours. It describes the relationship *between* kilometres and hours; that is, in one hour, 80 kilometres is travelled. Similarly, in \$4.98/L the units are dollars and litres; it is read as '\$4.98 per litre' and means \$4.98 is the cost for one litre.

Comparing rates can be difficult when the units are not referring to the same amount. For example, which is faster, 10 kilometres in 2 hours or 12 kilometres in 3 hours? We compare them by changing each to kilometres in 1 hour. 10 km/2 hours is equal to 5 km/1 hour and 12 km/3 hours is equal to 4 km/1 hour. Therefore 10 km/2 hours is faster than 12 km/3 hours. When one of the units within a rate is expressed as a quantity of 1 (e.g. km/1 hour), we call this a **unit rate**. Unit rates help us compare and solve problems involving different rates, such as speeds, prices, exchange rates.

In order to solve rate problems we need to refer to our decision making flow chart.



After deciding whether an exact answer is needed and whether to solve the problem mentally, or with a calculator, next we decide which operation to use. As shown in Unit 3 of the Foundation Mathematics course, rates problems are solved using multiplication or division. Hence we will be focussing on choosing *between* the operations of multiplication and division to solve everyday rates problems. As in solving all problems, it is important to check how our answer is expressed and whether it is reasonable.

Whole Class Activity 1

Think: How do we read, write and say a rate?

Look at the following common sign. What does this mean? Share your thinking with a partner and discuss any differences.

The sign shows a rate. Write this in two ways; using the '/' symbol, and using the word 'per'.



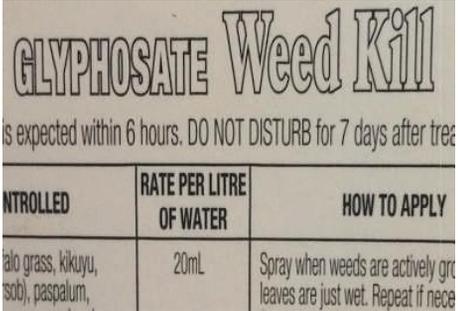
What are the two units of measurement in the rate?



What is the relationship between the two units of measure?



Complete the following table concerning commonly used rates.

Situation	What are the two units of measurement in the rate?	What is the relationship between the two units?	Write the rate in a form NOT shown.						
 <p>GLYPHOSATE Weed Kill is expected within 6 hours. DO NOT DISTURB for 7 days after treat</p> <table border="1" data-bbox="206 646 664 794"> <thead> <tr> <th>CONTROLLED</th> <th>RATE PER LITRE OF WATER</th> <th>HOW TO APPLY</th> </tr> </thead> <tbody> <tr> <td>alo grass, kikuyu, (sob), paspalum,</td> <td>20mL</td> <td>Spray when weeds are actively gro leaves are just wet. Repeat if nece</td> </tr> </tbody> </table>	CONTROLLED	RATE PER LITRE OF WATER	HOW TO APPLY	alo grass, kikuyu, (sob), paspalum,	20mL	Spray when weeds are actively gro leaves are just wet. Repeat if nece			
CONTROLLED	RATE PER LITRE OF WATER	HOW TO APPLY							
alo grass, kikuyu, (sob), paspalum,	20mL	Spray when weeds are actively gro leaves are just wet. Repeat if nece							
 <p>12GB \$50/mth</p>									
 <p>save 4^c per litre</p>									
 <p>x1000rpm</p>									

In which situation would you find each of the above rates?



List any other common uses of rates not shown in the table.



Practice Exercise 1

1a) Circle the rates in the following box:

72 km/h	25 mm	71 beats/minute	\$45.89	62 m ²	25 mL/5L
3.56 cm	9.3 m/sec	\$17.89/kg	23 × 19	2 tsp per 3 tbs	
8 sit-ups per 30 seconds	\$18/hr		\$1.41/L	\$32 per 100 g	

b) Match the following everyday situations to one of the circled rates in the table above:

Petrol Prices
Average Speed
Exercising

Pulse rate
Recipes
Food prices

Mixing herbicide
Wages

2. What two units of measure should be considered to work out a rate for each of the following? Write a rate for each. The first has been done for you.

	Two units of measure	Rate
a) Cycling speed	1. Distance - kilometres 2. Time - hours	Kilometres per hour
b) Application of granular fertilizer	1. 2.	
c) Interest on your savings	1. 2.	
d) Cost of carpet	1. 2.	
e) Growth of a plant	1. 2.	
f) Renting a house	1. 2.	

3. For the following problems:

- Circle the problems that involve rates.
 - Highlight the problems that involve finding a rate as the answer.
- a) Dale earned \$12/hour. How much would he earn if he worked for 7 hours?
- b) Htet paid \$23 400 in rent for a year. How much was this per week?
- c) Danielle made a drink mixing 50 mL cordial per 1 litre of water. How much cordial would she mix with 7 L of water?
- d) Find the area of a rectangle measuring 5.3 cm by 8.2 cm.
- e) What is the average speed of a vehicle travelling 150 km in 2 hours?
- f) Jane can row 4 lengths of a rowing course in 30 minutes. How many lengths can she do per hour?

Whole Class Activity 2

Think: How do we solve everyday problems involving rates?

In the examples above, which operations have been used to solve the problems?

In Unit 3, we learnt that rates used multiplication or division to solve. Hence, when using the decision making flow chart to guide our problem solving for rates situations, the focus is on *choosing between* multiplication and division.

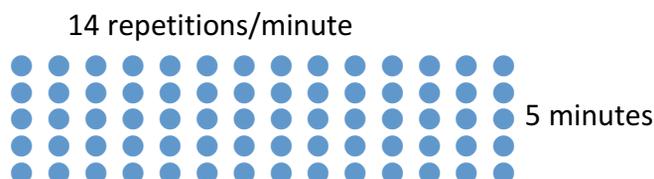
SITUATION A:

Angela lifted weights at a rate of 14 repeats/minute. If she pumped for 5 minutes, how many repetitions did she do?

To solve this problem you need to decide whether to use multiplication or division.

We could try using an array diagram.

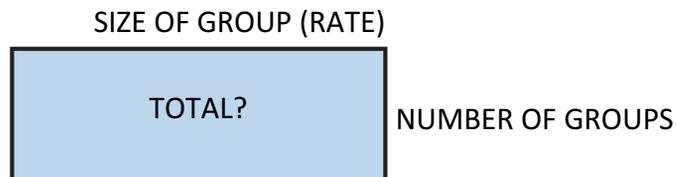
We can draw dots to show 14 in one minute, 28 in two minutes and so on.



We can use a diagram so that we do not have to draw in all the dots.



In previous units we have used the following array diagram to help us choose between multiplication and division.



However, a rate **is not** the 'Size of the Group', it is a relationship between the two units of measure in the problem. Therefore, this form of the array diagram can be unhelpful in solving rate problems.

Another way to solve rate problems is to set up a table.

1 minute	14 repetitions
5 minutes	? repetitions

This table shows 14 repetitions in one minute, and includes a question mark for how many repetitions in five minutes.

This table suggests that we need to multiply 14 by 5 in order to work out the missing number.

$$14 \text{ repetitions per minute} \times 5 \text{ minutes} = 70 \text{ repetitions in five minutes.}$$

SITUATION B:

How many minutes did Angela pump for if she worked at 14 repeat/minute and did 126 repetitions?

We can set up a rates table as follows:

1 minute	14 repetitions
? minutes	126 repetitions

This table shows 14 repetitions in one minute, and includes a question mark for how many minutes it takes to complete 126 repetitions.

$$14 \text{ repetitions per minute} \times ? \text{ minutes} = 126 \text{ repetitions}$$

This has an equivalent number sentence of: $126 \div 14 = ?$

We can then use a mental strategy or calculator to find the answer.

It takes 9 minutes to complete 126 repetitions.

Work with a partner to set up a rate table for each of the following problems. The first has been done for you.

a) Dale earned \$12/hour. How much would he earn if he worked for 7 hours?

1 hour	\$12
7 hours	?

b) Htet paid \$23 400 in rent for a year. How much was this per week?

c) Danielle mixed 50 mL cordial per 1 litre of water. How much cordial could she need to mix with 7 L of water?

d) What is the average speed of a vehicle travelling 150 km in 2 hours?

e) Jane can row 4 lengths of a rowing course in 30 minutes. How many lengths can she do per hour?

When you use a rate table, how do you know when to multiply and when to divide?



Whole Class Activity 3

Think: How do we interpret our answers when solving rate problems?

What does the number in the answer to the following two problems mean?

Jim has \$500 which he shared with his brother.

$500 \div 2 = 250$ 250 refers to dollars. Each person received \$250.

Jim paid \$5.00 for two kilograms of bananas.

$5.00 \div 2 = 2.50$ 2.50 refers to price per kilogram.

In the first problem the number refers to one of the amounts in the problem (dollars).

In the second problem the number refers to a relationship between the two amounts in the problem (price per kilogram).

Write a number sentence for each of the following problems, using your calculator to find the answer. What do the numbers in the answers refer to?

A visit to the movies costs \$18 per person. If 5 people go to the movies, how much does it cost?



A 747 jet travels 1 840 kilometres in two hours. What is its average speed?



Practice Exercise 2

1. Write a number sentence to solve each of the problems.

Below each number sentence write what each of the numbers mean. The first has been done for you.

a) Dale earned \$12/hour. How much would he earn if he worked for 7 hours?	12	\times	7	$=$	84
	Dollars per hour		Number of hours		Dollars earned in 7 hours

b) Htet rented a house at \$450/week. How much rent would he pay in a year?					

c) Danielle mixed 50 mL cordial per 1 litre of water. How much cordial would she need to mix with 7 L of water?					

d) What is the average speed of a vehicle travelling 150 km in 2 hours?					

e) Jane can row 4 lengths of a rowing course in 30 minutes. How many lengths can she do per hour?					

Practice Exercise 3

1. Solve the following problems using the decision making process outlined by the flow diagram on page 8.

a) Sarah filled the petrol tank in her car with unleaded petrol and it cost \$55.65. At the petrol station, unleaded petrol cost \$1.32/litre. How many litres of petrol did she put in her car?

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Circle: MENTAL or CALCULATOR
3. Draw a rate table to represent the situation.
4. Circle: MULTIPLICATION or DIVISION? Write a number sentence(s) to show the calculation.
5. Calculate the SOLUTION.
6. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

b) Tony earned \$600 for working 30 hours. How much did he earn per hour?

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Circle: MENTAL or CALCULATOR
3. Draw a rate table to represent the situation.
4. Circle: MULTIPLICATION or DIVISION? Write a number sentence(s) to show the calculation.
5. Calculate the SOLUTION.
6. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

c) Nat had \$60 in her wallet. Cherries cost \$14.98/kg. About how many kilograms of cherries could Nat buy?

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Circle: MENTAL or CALCULATOR
3. Draw a rate table to represent the situation.
4. Circle: MULTIPLICATION or DIVISION? Write a number sentence(s) to show the calculation.
5. Calculate the SOLUTION.
6. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

d) Bernadette was mixing 75mL of disinfectant per litre of water to make a floor cleaner. How much disinfectant should Bernadette put in a 9 litre bucket of water?

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Circle: MENTAL or CALCULATOR
3. Draw a rate table to represent the situation.
4. Circle: MULTIPLICATION or DIVISION? Write a number sentence(s) to show the calculation.
5. Calculate the SOLUTION.
6. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

e) Ruby drives 552.5 km at 85 km/h. How long does it take Ruby to complete the drive?

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Circle: MENTAL or CALCULATOR
3. Draw a rate table to represent the situation.
4. Circle: MULTIPLICATION or DIVISION? Write a number sentence(s) to show the calculation.
5. Calculate the SOLUTION.
6. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

f) A toy assembly line packs blocks in boxes at a rate of 3 boxes per minute. How many boxes can it pack in one hour?

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Circle: MENTAL or CALCULATOR
3. Draw a rate table to represent the situation.
4. Circle: MULTIPLICATION or DIVISION? Write a number sentence(s) to show the calculation.
5. Calculate the SOLUTION.
6. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

2. Circle the rate problems below that require an approximate answer:

- a) Ashley cycles at 25 km/h for $\frac{1}{2}$ an hour. How far does she travel?
- b) The rate on a cordial bottle is 150 mL per litre of water. If Connor has 3.05 litres of water in a container, how much cordial should he add?
- c) The Indonesian Rupiah is worth 8 000 Rupiah per one Australian dollar. Ryan has 40 000 rupiah. How many Australian dollars is this?
- d) Terri has \$20 in her purse. She wants to buy steak costing \$39.88/kg. How many kilograms could Terri buy?

Justify which operation, multiplication or division, best solves the problems in question 2 above.

3. Place each problem number from question 2 in the correct side of the table and follow the instructions to solve.

MULTIPLICATION PROBLEMS	DIVISION PROBLEMS
<p>Problem: Rate Table</p> <p>Number sentence to find answer</p> <p>Strategy and solution</p> <p>Answer written in sentence form</p>	<p>Problem: Rate Table</p> <p>Number sentence to find answer</p> <p>Strategy and solution</p> <p>Answer written in sentence form</p>
<p>Problem: Rate Table</p> <p>Number sentence to find answer</p> <p>Strategy and solution</p> <p>Answer written in sentence form</p>	<p>Problem: Rate Table</p> <p>Number sentence to find answer</p> <p>Strategy and solution</p> <p>Answer written in sentence form</p>

4a) Penny is selling bananas for \$7.25 per kilogram at a local farmer's market. Circle the operation she would key into her calculator to find the cost for each amounts of bananas:

4 kg	$7.25 + 4$	7.25×4	$7.25 \div 4$	$7.25 - 4$
$4\frac{3}{4}$ kg	$7.25 - 4.75$	$7.25 \div 4.75$	7.25×4.75	$7.25 + 4.75$
1.25 kg	$7.25 \div 1.25$	$7.25 + 1.25$	$7.25 - 1.25$	7.25×1.25
0.75 kg	7.25×0.75	$7.25 - 0.75$	$7.25 + 0.75$	$7.25 \div 0.75$

b) Explain your choice of operation in the above problems using a rate table.

5a) Penny wants to make \$500 from her market stall selling bananas. Circle the operation she should use to work out the rate per kilogram, if she starts the day with the following amount of bananas:

40kg	$500 + 40$	500×40	$500 \div 40$	$500 - 40$
65 kg	$500 - 65$	$500 \div 65$	500×65	$500 + 65$
$55\frac{3}{4}$ kg	$500 \div 55.75$	$500 + 55.75$	$500 - 55 + 3 - 4$	500×55.75
80.625 kg	500×80.625	$500 - 80.625$	$500 + 80.625$	$500 \div 80.625$

b) Explain your choice of operation in the above problems using a rate table.

6. Peta is travelling from Perth to Goomalling, a distance of 145 km. She drives at an average speed of 75 km/h.

Match the word problems with one of the following number sentences:

a) How long did it take Peta to get to Goomalling?	$75 \div 0.75$
b) Peta travelled at 60 km/h for the first $\frac{1}{2}$ hour as she left Perth. How far did she travel at this speed?	$60 \div 0.5$
c) Peta travelled the next 75 km of her journey in $\frac{3}{4}$ hour. What was her average speed?	$145 \div 75$
d) Peta then drove at 75 km/h for the next $\frac{3}{4}$ hour. How far did she travel in this stage of her journey?	$145 + 75$
	75×0.75
	60×0.5
	$75 + 0.75$

7. Employees at the 'Good Food Grill Bar' are paid their normal wage during the week, time and a half on Saturdays and double time on Sundays. Fill all missing gaps on the following payslips:

Luke Clark: Normal Rate \$25/hr			
	Hourly Rate	Hours	Wage
Mon – Fri		30	
Sat			\$375
Sun		3	
TOTAL WAGE			

Briony Broom: Normal Rate \$?/hr			
	Hourly Rate	Hours	Wage
Mon – Fri		25	\$350
Sat		2	
Sun			\$280
TOTAL WAGE			

8. The March family have recently bought a rainwater tank and need some help solving the following problems.

- Rain water flows into the tank at a rate of 5 litres per minute. How much water will be in the tank after 25 minutes?
- How much will be in the tank if it rains steadily for 1 hour?
- If the tank holds 850 litres, how long will it take to fill the tank?
- If water flows out of the tank at 3 litres per minute, how much water will Mrs March have used if she waters the garden for 15 minutes?
- How much water will she have used if she waters the garden for one hour?
- Mrs March accidentally leaves the garden hose on. How many minutes will it take her to half empty the full tank?

Whole Class Activity 4

Think: How can we compare different rates?

SITUATION: Sarah types 123 words in 3 minutes. Jalen types 242 words in $5\frac{1}{2}$ minutes. Sarah thought she was the fastest typist.

I wonder how we can compare our typing speed.



Complete the table to establish a process for comparing.

SARAH	JALEN
Write Sarah's <i>words per minutes</i> as a rate?	Write Jalen's <i>words per minutes</i> as a rate?
What are the two units of measure in the rate?	What are the two units of measure in the rate?

How can we compare the two typists to find the fastest?



If we find the number of words for ONE minute, we will be able to compare our typing speeds.

Is an estimate or an accurate answer required?	Is an estimate or an accurate answer required?								
Place the number of <i>words</i> and <i>minutes</i> in the correct place in a rate table. <div style="text-align: center;"> <table border="1" style="width: 100px; height: 60px; background-color: #ADD8E6;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> </table> </div>					Place the number of <i>words</i> and <i>minutes</i> in the correct place table in a rate table. <div style="text-align: center;"> <table border="1" style="width: 100px; height: 60px; background-color: #ADD8E6;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> </table> </div>				
What operation are you using to find the number of words in one minute?	What operation are you using to find the number of words in one minute?								
Write a number sentence to calculate the number of words in one minute.	Write a number sentence to calculate the number of words in one minute.								
Compare the number of words in one minute. Who is the fastest typist?									

Use the number of words per one minute for each typist to find out how many words both Sarah and Jalen would type in (i) 10 minutes (ii) 15 minutes. Show your working in the space below.

--	--

Why is being able to calculate a rate for one minute helpful?



Converting a rate to the amount per one of the measurement units is called a unit rate. The unit rate allows us to compare different rates.

Practice Exercise 4

1. Convert the following rates to unit rates by placing the numbers into a rate table and choosing the correct operation. The first one has been done for you.

RATE	RATE TABLE	NUMBER SENTENCE(S)	SOLUTION				
a) 160 km in 4 hours	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">1 hour</td> <td style="text-align: center;">?</td> </tr> <tr> <td style="text-align: center;">4 hours</td> <td style="text-align: center;">160 km</td> </tr> </table>	1 hour	?	4 hours	160 km	$4 \times ? = 160$ $160 \div 4 = ?$	The unit rate is 40 km/h
1 hour	?						
4 hours	160 km						
b) \$45 for 3 hours work							
c) 78 words per 2 minutes							
d) 80 km ² for 40 people							
e) 15 000 revs in 2.8 mins							
f) 156 beats in 1 and a half minutes							

2. Determine which cyclist is the fastest:

- a) MURPHY J: 90 km in 3 hours
- b) HARVEY K: 91 km in $3\frac{1}{2}$ hours
- c) RAHUL L: 110 km in 4 hours
- d) FERGUSON P: 70 km in 2 hours and 30 minutes
- e) NYUNG B: 40 km in 1 hour and 15 minutes
- f) PATTERSON N: 86.625 km in $2\frac{3}{4}$ hours

3. Solve the following problems by finding the unit rate.

- a) Ribbon costs \$3.75 for 3 metres. How much would it cost for 2 metres?
- b) Peter's pulse rate is 134 beats per 30 secs. How many beats would he have in 3 minutes?
- c) Giovanni earns \$45 for 3 hours work. How much would he earn in 5 hours?
- d) A taxi fare is \$15.50 for 5 km. How much would the fare be for 22 km?
- e) Lucy makes an international call on her mobile and it costs \$9.80 for 4 minutes. How much would it have cost her for a 7 minute call?
- f) A recipe uses 180 grams of sugar to make 24 biscuits. How much sugar would you need if you wanted to make 18 biscuits?

4. The following image appears on the odometer of a car driven by Thomas.



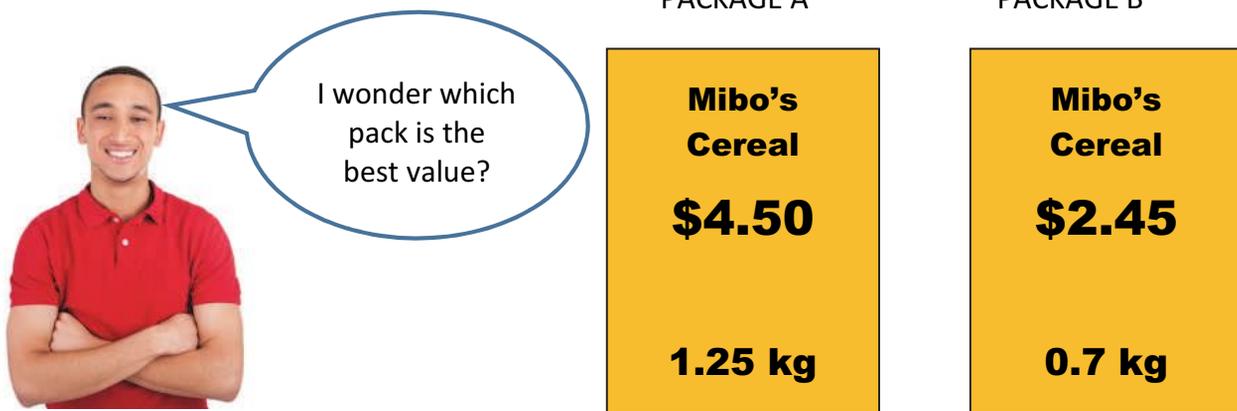
- a) What does 6.2 L/100 km mean?
- b) Why does it show the fuel consumption per 100 km and not per 1 km?
- c) If Thomas drove 200 km, how much fuel would he use?

- d) If Thomas drove 325 km, how much fuel would he use?
- e) How many kilometres can Thomas drive on 20 L of fuel?
- f) Thomas' friend Rory can drive 400 km using 68.6 litres of fuel. Whose car has the better fuel consumption?

Whole Class Activity 5

Think: How can we use our understanding of rates to compare prices in shops?

Casey was comparing the price of the same cereal packed in different size boxes.





I wonder which pack is the best value?

PACKAGE A

Mibo's Cereal

\$4.50

1.25 kg

PACKAGE B

Mibo's Cereal

\$2.45

0.7 kg

How can Casey compare the price of the two packets? Use your knowledge of comparing rates to complete the following table:

PACKAGE A	PACKAGE B
Write the price for 1.25 kg as a rate?	Write the price for 0.7 kg as a rate?
Is this a unit rate? Explain.	Is this a unit rate? Explain.
Place the price and the weight in the correct place in a rate table.	Place the price and the weight in the correct place in a rate table.

What operation are you using to find the unit rate?	What operation are you using to find the unit rate?
Write a number sentence to calculate the unit rate.	Write a number sentence to calculate the unit rate.
Which is the best value package to buy?	

The Australian Competition and Consumer Commission states that all prices in major supermarkets must be able to be compared using the same rate.

View the Australian Competition and Consumer Commission website:

<https://www.accc.gov.au/consumers/groceries/grocery-unit-prices>

Write down 4 points of interest concerning how rates are used to compare items in major stores.

-
-
-
-

The pricing for the two cereal packages above had a sentence missing below the weight on each sign.

PACKAGE A	PACKAGE B
Mibo's Cereal \$4.20 1.25 kg \$0.34 per 100 g	Mibo's Cereal \$2.45 0.7 kg \$0.35 per 100 g

Why would supermarkets choose to show the price per 100 grams and not the price per one gram or one kilogram on price labels?



Would you have expected package A to be cheaper? Explain your thinking.



What rate do supermarkets display for items that are liquids? Why would they choose this rate?



Why did the Australian Competition and Consumer Commission insist that prices must be displayed with a common rate (e.g. price per 100 g)?



Practice Exercise 5

1. Mrs Marsh compared the prices of sausages in meat trays across 5 different supermarkets. She wrote down the following results;

SHOP A: \$60 for 5 kg

SHOP D: \$39 for 3 kg

SHOP B: \$18.75 for 1.5 kg

SHOP E: \$35.85 for 3 kg

SHOP C: \$26.07 for 2.2 kg

Which shop had the cheapest sausages? How do you know?

2. These customers paid the following amounts for petrol;

Mr Brown: \$75 for 50 L

Penny: \$35.25 for 25 L

Bernard: \$77.91 for 53 L

Jill: \$90.09 for 63 L

Maureen: \$25.90 for 17.5 L

Who had the cheapest rate of petrol? How do you know?

3. Cola at Ormond's supermarket comes in a carton of 24 cans and costs \$17.99. The same type of cola is sold at Ray's supermarket in cartons of 18 for \$14.99.

a) Write the price of cola at each supermarket as a rate.

b) What is the price per can at each supermarket? Write these as unit rates.

c) Which is the better buy?

4. A 2 kg bag of flour costs \$3.60 and a 3 kg bag is \$5.10.
- Write the price of each bag of flour as a rate.
 - What is the price of each bag of flour for each kilogram? Write these as unit rates.
 - Which is the better buy?

Reflection on Learning

1. For the following problems, solve only those that:

- Require an exact answer AND
- Involve rates

- Jane buys 0.3 kg of pears and it costs \$2.70. What is the price of pears per kilogram?
- Jaxon compares the prices of two different sizes of 'Spreadable' margarine. The 750 g size costs \$3.29 and the 500 g size costs \$2.89. Which size is the best buy?
- Rebecca can type at 41 words per minute. How long would it take her to type a document that has 11 389 words?
- Nikita works for $6\frac{1}{2}$ hours per day Monday to Friday. How many hours does she work in total?
- John spends \$45 on Saturday and \$78 on Sunday. How much does he spend in total on the weekend?
- Nikita pays \$500 in TV rental over a year. How much is this per week?
- Brodeys car uses 9.6L/100 km in petrol. How many litres would he use if he travelled 350 km?
- Kaye drives 150 km in 2 hours. Assuming she drives at the same speed, how far does she drive in 3 hours?

2. Reflect on the answers to each of the problems above. What do the numbers in the answers mean?

- | | |
|----|----|
| a) | e) |
| b) | f) |
| c) | g) |
| d) | h) |

OLNA Practice Questions

1. Veronica drove 300 km in 4.5 hours. She travelled at 60 km/h for the first 180 km. How long did it take Veronica to travel the last 120 km?
A. 3 hours B. 1.5 hours C. 2 hours D. 2.5 hours
2. A plumber calculates the price of a job using a service fee and an amount per hour. This table shows some of the job prices:

Hours	Job Price
2	\$160
4	\$252
5	\$298

How is the job price calculated?

- A. \$68 service fee + \$92 per hour
- B. \$68 service fee + \$46 per hour
- C. \$80 service fee + \$40 per hour
- D. \$80 service fee + \$80 per hour

Topic 2

Ratio

Mathematics Discussion

Ratios are used to give an indication of the relative size of two or more quantities (instead of the exact size). For example, a garden mixture which includes one part compost to two parts soil can be used to make a small quantity or a large quantity by keeping the proportions the same.

compost	1	2	3	4	5		10	20		1000
soil	2	4	6	8	10		20	40		2000

Ratios can be written in a variety of ways. The garden mixture which uses a ratio of one part compost to two parts soil, can be written as '1 to 2' or as '1:2'. Alternatively, we could refer to this ratio as two parts soil to one part compost and write it as '2 to 1' or '2:1'.

Ratios can be used in different ways; sometimes we use part-to-part ratios as in the garden mixture above, and sometimes we use part-to-whole ratios. We could refer to the garden mixture as one part compost to three parts in total. In this case the ratio would be written as '1 to 3' or as '1:3'. It is important when dealing with ratios to know whether you are using part-to-part ratio, or part-to-whole ratio, in order to avoid using the wrong amounts.

Sometimes ratios are used to show the relative size of more than two quantities. For example, a vegetable garden mixture might include one part compost, one part clay and two parts sand. This ratio would be written as '1 to 1 to 2' or '1:1:2'.

We sometimes write ratios as a special form of fractions. For example, a cleaner can be made from one part vinegar to two parts water. This could be written as 1:2 or $\frac{1}{2}$ (part-to-part ratio) or as 1:3 or $\frac{1}{3}$ (part-to-whole ratio). When we use fractions to represent ratio we cannot add or subtract them in the normal way. For example, if we doubled this cleaner recipe using the part-to-whole ratio, i.e., adding $\frac{1}{3}$ to $\frac{1}{3}$, the ratio of vinegar to water in the doubled recipe would still be 1:3, i.e., 1 part vinegar to 3 parts water. Hence the result is $\frac{1}{3}$ instead of $\frac{2}{3}$.

We can also write ratios using percentages. In the cleaner recipe, 33.33% ($\frac{1}{3}$) of the total mixture is vinegar and 66.66% ($\frac{2}{3}$) is water. We can use this percentage to make any small or large amount of cleaner in the same way that we can use the ratio in the garden mixtures to make different amounts.

Writing ratios as fractions or percentages helps us to compare them. For example, which recipe uses the most butter, one with a ratio of 1:3 or one with a ratio of 2:5? Converting them to fractions $\frac{1}{3}$ and $\frac{2}{5}$ we can then use equivalent fractions: $\frac{1}{3}$ is the same as $\frac{5}{15}$ and $\frac{2}{5}$ is the same as $\frac{6}{15}$, so the recipe with the ratio of 2:5 has more butter.

Whole Class Activity 1

Think: How do we read, write and say ratios?



To make cordial you mix 1 part cordial syrup with 9 parts water. This is a ratio of “1 to 9.”

On the glass draw the cordial part of this mixture red and the water parts blue.



Fill in the blanks to describe the relationship.

For every _____ part of cordial, there are _____ parts of water.

Ratios can be written as numbers separated by a colon. In the cordial example we write the ratio of syrup to water as 1:9. This means,

Syrup	Water
1	9

The order we write the numbers in a ratio is important to how we understand it.

What is the ratio of water to syrup?



These examples describe the relationship between the parts of the mixture.

This is a part-to-part ratio. It can be written as the fraction $\frac{1}{9}$.

Part-to-part ratio $\frac{1}{9}$ 1 part cordial
9 parts water

Ratios can also be used to describe a part-to-whole relationship.

In the cordial example, the whole drink is made up of 10 parts.

So, the cordial syrup is $\frac{1}{10}$ of the whole mixture and the water is $\frac{9}{10}$ of the whole mixture.

This gives a part-to-whole ratio.

Part-to-whole ratio $\frac{1}{10}$ 1 part cordial
10 parts in the whole mixture

Discuss with a partner the difference between part-to-part and part-to-whole ratio.

Ratios can be written as percentages. Use your knowledge of converting fractions to percentages to convert the part-to-whole ratios to percentages.

What percentage of the cordial mixture is water?



What percentage is cordial syrup?



Whole Class Activity 2

Ratio can involve more than two parts.

The recommended ratio for mixing cement for use in paths and driveways is:

1 part cement, 2 parts sand and 3 parts aggregate.

Write this as a ratio using colons.



Draw this ratio as a diagram.



How many parts make up the whole?

What fraction of the whole mixture is cement?

What fraction of the whole mixture is sand?

What fraction of the whole mixture is aggregate?

Use your calculator to work out:

What percentage of the whole mixture is cement?

What percentage of the whole mixture is sand?

What percentage of the whole mixture is aggregate?

When there are more than two parts in a ratio, comparisons can be made between the parts.

What is the ratio of cement to sand?

What is the ratio of sand to aggregate?

What is the ratio of cement to aggregate?

Practice Exercise 1

1. Read the problem situations below and circle the problems that involve ratio.

a) Toni was mopping the floors and needed to mix 1 part of disinfectant to 19 parts of water. If 1 part is 100 mL how much water is needed?

b) The recipe requires 350 mL of milk and 15 mL of vanilla essence and 150mL of cream. How much liquid is needed for the recipe?

c) Hui had \$155 saved up and then earned some more by doing chores. He now has \$210. How much did Hui earn?

d) Customers were surveyed as they left the movie theatre. For every 5 people who said they liked it, 2 did not like it.

e) The brownie recipe has 1 cup of chocolate chips for every 2 cups of flour and 1 cup of sugar. If I double the recipe how much of each ingredient will I need?

f) On the trip to Geraldton, the car averaged 65 litres of fuel for every 500 km. How much fuel is being used every 100 km?

g) The paint must be mixed with thinner. For every 3 parts of paint, I must add 9 parts of thinner. How much thinner will I need to purchase if I am using 500 ml of paint?

2. For each of the ratio problems you circled above, express the ratio as a number, and as a sum of fractions and percentages. The first has been done for you.

Part-to-part Ratio	Part-to-whole Ratio	Fraction	Percentage
1:19	1:20 and 19:20	$\frac{1}{20} + \frac{19}{20}$	5% + 95%

3. When fixing holes in plaster walls you need to mix plaster powder with water. The packet says to mix, '3 parts powder to 1 part water.'

a) You have these materials for measuring and mixing.



Explain how you would combine the ingredients to make the plaster paste.

b) Write the plaster mixture as a part-to-part ratio.

Write the plaster mixture as a part-to-whole ratio.

In these ratios, which number refers to the powder and which refers to the water?

c) What fraction of the mixture is powder?

What fraction of the mixture is water?

In these fractions, what do each of the digits refer to?

d) What percentage of the mixture is powder?

What percentage of the mixture is water?

4. Macie works at a nursery where they make their own soil mix for growing plants.

The mixture is made up of sawdust, sand and peat. The ratio is 2 parts sawdust to 2 parts of sand and 1 part of peat.

a) Complete the table below.

	Sawdust	Sand	Peat	Whole
Ratio	:		:	
Fraction				
Percentage				

Whole Class Activity 3

Think: How do we use ratios to vary the quantities or proportions?

Bakers in commercial bakeries make different amounts of dough using a part-to-part ratio of 5:3, flour to water. They also add small amounts of salt and yeast, but for this activity we won't include these.

We will use 100 grams as the weight of 1 part. One millilitre of water weighs 1 gram, so we can convert the millilitres amount to grams. Draw a diagram to show the ratio of flour to water in this mixture. Label the amount of flour and water using grams.

Complete the table using different weights for 1 part.



Flour to water ratio 5:3			
Weight of 1 part	Flour	Water	Weight of Mixture
100 g	$100 \text{ g} \times 5 = 500 \text{ g}$	$100 \text{ mL} \times 3 = 300 \text{ mL}$ (300 mL = 300 g)	800 g
50 g			
150 g			
200 g			
80 g			

Practice Exercise 2

- This ratio will make the perfect pie pastry, 3 parts flour, 2 parts butter and 1 part water.
 - Is this ratio a part-to-part ratio or a part-to-whole ratio?
 - Use this information to complete the table. Show your working out in the cells.

Pie Dough Ratio				
Weight of 1 part	Flour	Butter	Water	Weight of Mixture
100 g				
50 g				
120 g				

2. When dying your hair, you mix 2 components together - colour and developer. The *My Hairdresser* line of products recommends using a ratio of 1 part colour to 2 parts developer.

a) Write this as a ratio using a colon.

b) What fraction of the mixture is colour?

c) If I measured 100 mL of colour, how many millilitres of developer would I need? How many millilitres of mixture should I have altogether?

d) A person with long hair needs more mixture to cover their hair than someone with short hair. If the amount of 1 part is increased to 200 mL, how much colour and developer are needed?

3. Marwa works at a juice bar. There are three drink sizes, and the ratio for each size is the same.

Regular = 250 mL

Medium = 400 mL

Large = 750 mL

Ratio Recipe for Tropical Juice

1 part coconut juice

2 parts pineapple juice

2 parts guava juice

Work out the quantities of each juice needed to make the three different sizes of Tropical Juice. Show how you worked out each quantity.

Tropical Juice Ratio			
Size	Coconut	Pineapple	Guava
Regular			
Medium			
Large			

4. Go to the Vitality Drinks learning object on Scootle.

<https://www.scootle.edu.au/ec/resolve/view/L8867>

Complete the activity, print out the results and staple to this page.

Whole Class Activity 4

Think: How do we increase and decrease amounts in ratios?

At the *Puggles Childcare Centre* the ratio of adults to children is 1:3.

Draw this as a diagram in the first row of the table below.

Number of Adults	Number of Children

Complete the table so that each row of the table increases the number of children by three. Show how many adults are required as the amount of children increases.

What happened each time the amount of children increased?



What operation/s can be used to calculate the number of children when you know the number of adults?



In Australia there are rules in childcare centres about the ratio of educators to children.

Go to the following site to find the current educator to child ratios for Australia.

[http://files.acecqa.gov.au/files/Information%20sheets/Information sheet New educator to child ratios.pdf](http://files.acecqa.gov.au/files/Information%20sheets/Information%20sheet%20New%20educator%20to%20child%20ratios.pdf)

Summarise the information for educator to child ratios in childcare centres, on the table below.

Educator to Child Ratio		
Age Group	Ratio in numbers	Write in words
Birth to 24 months		
24 months to 36 months		
36 months to preschool age		

For this activity we will use the educator to child ratio for the age group 24 months to 36 months.

Write the ratio at the top of the table below.

Complete the table showing how many children can be at the centre in relation to the number of educators.

Educator to child ratio is					
Number of educators	1	2	3		
Number of children					

What operation did you use to calculate the number of children, when you knew the number of educators? Use the table below to work out the number of children that can attend if there are 7 adults.

1 adult	3 children
7 adults	? children

What operation would you use to calculate the number of educators if you knew the number of children? Use the table below to work out the number of adults required if there are 28 children attending.

1 adult	3 children
? adults	28 children

A ratio can be simplified using a table like the ones above and thinking about the relationship between the numbers.

At the *Puggles Childcare Centre* there are 12 boys and 18 girls enrolled. We can express this as a simplified ratio. Both numbers need to be divided by the same factor.

What factor can 12 and 18 be divided by?



Now divide 12 and 18 by this factor and write into the table.

12 boys	18 girls

What is the simplified ratio of boys to girls enrolled at *Puggles Childcare Centre*?



Practice Exercise 3

1. The brownie recipe has a ratio of 8 parts sugar, 5 parts flour, 4 parts butter, 4 parts egg and 3 parts chocolate.

a) If 1 part is 50 grams complete the table to show the weight of each ingredient needed for the recipe.

Sugar	Flour	Butter	Egg	Chocolate

b) If the recipe is doubled what happens to the ratio?

c) Write how much of each ingredient is needed if the recipe is doubled.

2. If the ratio of men to women at the company is 4:7 how many men and women could work at the company?

a) Use a table to show the possible combinations of men and women.

Men	Women

b) If there were 20 men working at the company, how many women would be working at the company?

c) The company employs a total of 66 people, how many men and women work there?

d) If 5 more men and 2 extra women are employed, what will the new ratio be?

3. The scale of this aerial photograph is 1:20 000



- a) In your own words describe what the ratio 1:20 000 means.
- b) How do you use the ratio to work out distances on the aerial photograph? (HINT: Will you be scaling up or scaling down?)
- c) What is the distance between A and B? Show your calculation below.
- d) What is the distance between A and C? Show your calculation below.
- e) Estimate the area of carpark A?

4. Rebecca is planning to renovate her kitchen. She is drawing a scale plan of the design using a ratio of 1:20

- a) In your own words, describe what the ratio 1:20 means.
- b) How do you use the ratio to work out how big to draw the kitchen design? (HINT: Will you be scaling up or scaling down?)

c) These are the length and width measurements of some items that must be on the scale plan. Calculate how big each drawing needs to be if they are drawn using the 1:20 ratio.

Fridge: 800 mm x 700 mm

Oven: 600 mm x 600 mm

Sink: 860 mm x 440 mm

Pantry: 800 mm x 400 mm

Island Bench: 900 mm x 2500mm

d) On a separate piece of grid paper, create a sketch of the kitchen plan using the items above and any others you would like to include. Use a scale of 1:20. Staple the sketch to this page.

5. Simplify the following ratios.

- | | |
|----------|-------------|
| a) 15:60 | e) 10:8 |
| b) 4:18 | f) 24:18 |
| c) 9:21 | g) 15:5:25 |
| d) 18:27 | h) 32:16:40 |

Whole Class Activity 5

Think: How do we compare ratios?

For this activity you will need;

Ribena or similar syrup concentrate, measuring cups with millilitres, water, cups and jugs.

Mix three different drinks using the part-to-part ratios on the table below. In this activity 1 part is 70mL. Show your calculations in the table.

Ratio of Concentrate to Water	Amount of Concentrate	Amount of Water	Quantity of Mixture (in mL)
2:3			
3:1			
2:8			

Taste the different drinks and put the ratios in order from weakest to strongest flavour.



On the table below, convert each ratio to a fraction and percentage, showing the amount of juice concentrate in the mixture. Show your calculations in the table.

Juice Concentrate to Water Ratio	Fraction of Juice Concentrate	Percentage of Juice Concentrate	Number Weakest to Strongest
2:3			
3:1			
1:5			

Discuss the following questions with a partner and then as a whole class. Jot down any useful ideas.

How did you work out the fraction of juice concentrate in each ratio?

How did you work out the percentage of juice concentrate in each ratio?



Practice Exercise 4

1. Download this document from Cockburn Cement

<http://cockburncement.com.au/wp-content/uploads/2014/03/Easy-Estimator-combined-for-email.pdf>

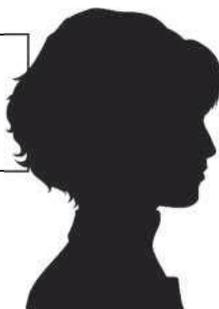
- What is the ratio of cement, lime and sand for M2 Mortar for limestone walls?
- What is the ratio of cement, sand and aggregate for mixing concrete for a floor slab?
- What is the ratio of cement, lime and sand for mixing a sand finish top coat of render?
- Which of these mixtures uses the biggest proportion of sand in the mixture? Convert the ratios to percentages to work it out.
- Which of these mixtures uses the biggest proportion of cement in the mixture? Convert the ratios to fractions to work it out.

Whole Class Activity 6

Think: How do we calculate with ratios?

A. Two students were making a large quantity of an energy drink for a marathon, using a ratio of 1 part concentrate to 9 parts water (1:9). They combined the two amounts into a large container and then tried to work out the ratio of concentrate to water in the combined amount.

I think $\frac{1}{9} + \frac{1}{9}$ equals $\frac{2}{9}$ so the ratio is 2:9



Jenna

I disagree. I think it is 1:9. The ratio stays the same.



Alice

Who is right?

How do you know? Use grid paper to draw a diagram of this scenario. Staple it to this page.

Use your diagram to explain your thinking to a partner.

B. Fractions can be used in different ways. Solve each of the problems below.

- Jack ate one third of an apple pie and then ate another one third of the same pie. How much pie did he eat?
- Jenny made two containers of cordial using one third concentration of juice in each, and then poured the two containers into one larger one. What is the concentration of cordial in the larger container?
- Pia scored one out of three on one section of a maths test and one out of three in another section of the test. What was her total score?

Why is the result different in each of the above questions?



Use diagrams to help describe how fractions are being used in each of the situations above.



Practice Exercise 5

1. Tick the situations below that involve ratio. Write the ratio as a fraction.

- a) The map has a scale of 1 cm on the map for every 100 000 cm on the ground.
- b) Petrol cost 92.9 cents per litre.
- c) We averaged 102 kilometres per hour on our trip to Esperance.
- d) For every Dockers supporter that went to the derby match there were three Eagles supporters.
- e) The salad dressing recipe said to mix one part vinegar to three parts of oil.
- f) Mum said I should save one third of my pay every time I get paid.

2. In each situation below calculate the new ratio for the combined amounts. Use grid paper or a diagram to help.

a) Saul made a fuel mixture with a ratio of 25 parts fuel to 1 part oil. He accidentally added that to a fuel mixture on the shelf with a ratio of 50 parts fuel to 1 part oil. What is the ratio of the new mixture?

b) On Monday the ratio of men to women visiting the hairdresser was 3:10, on Tuesday the ratio of men to women was 2:10 and on Wednesday the ratio of men to women was 5:15.

What was the ratio of men to women visiting the hairdresser during these three days?

c) Ally mixed the juice concentrate with water using a ratio of 2:10 and Fen mixed it using a ratio of 3:10. They decided to put the two mixtures together and see what it tasted like. What is the ratio of the new mixture?

d) Two cleaners at the hospital made a mixture of disinfectant and water. One cleaner mixed it using a ratio of 1:30. The other cleaner used a ratio of 2:20. If the two batches of disinfectant were added together, what would be the disinfectant to water ratio?

Reflection on Learning

1. Solve the following problems using the decision making process.

a) Toni was mopping the floors and needed to mix 1 part of disinfectant to 19 parts of water.

If 1 part is 100 mL, how much water is needed?

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Circle: MENTAL or CALCULATOR
3. Use a table to represent the situation.
4. Circle: MULTIPLICATION or DIVISION? Write a number sentence(s) to show the calculation.
5. Calculate the SOLUTION.
6. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

b) A brownie recipe has 1 cup of chocolate chips for every 2 cups of flour and 1 cup of sugar. If the recipe is quadrupled how much of each ingredient is needed?

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Circle: MENTAL or CALCULATOR
3. Use a table to represent the situation.
4. Circle: MULTIPLICATION or DIVISION? Write a number sentence(s) to show the calculation.
5. Calculate the SOLUTION.
6. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

c) Customers were surveyed as they left the movie theatre. For every 5 people who said they liked it, 2 did not like it. If 140 people viewed the movie, how many people did not like it?

1. Circle: APPROXIMATE ANSWER or EXACT ANSWER?
2. Circle: MENTAL or CALCULATOR
3. Use a table to represent the situation.
4. Circle: MULTIPLICATION or DIVISION? Write a number sentence(s) to show the calculation.
5. Calculate the SOLUTION.
6. IS THE ANSWER REASONABLE? What is the number referring to? Write the answer in a sentence using the words in the question.

OLNA Practice Questions

1. The ratio of red cars to silver cars in the car park is 14:35. Select the equivalent ratio.

A. 2:5

B. 1:7

C. 2:7

D. 5:2

2. In a class of 24 students the ratio of girls to boys is 5:7. Two extra boys and four extra girls join the class. What is the new ratio of girls to boys?

A. 2:4

B. 2:3

C. 7:8

D. 12:20

Section Two

Statistics and Probability



Content Focus

Foundation Mathematics

- 4.2.1 Identify everyday events in which predictions are made, based on probability
- 4.2.2 Identify and describe the use of statistics and various data displays in everyday contexts
- 4.2.3 Understand that chance is measured on a scale of 0 to 1, with zero meaning impossible and 1 meaning certain to happen
- 4.2.4 Place everyday terms for chance (certain, fifty/fifty, likely, impossible) on the 0 to 1 scale and relate them to fractions, decimals and percentages
- 4.2.5 Order outcomes from least likely to most likely, using simple fractions, decimals and percentages
- 4.2.6 Describe, compare and interpret the likelihood of everyday chance events using routine fractions, decimals and percentages
- 4.2.7 Predict the likelihood of familiar events happening, based on past experience or data
- 4.2.8 Collect and organise familiar data, choosing an appropriate table, graph or chart to clearly represent the data set
- 4.2.9 Construct graphs and charts from simple everyday data, using a spreadsheet, with simple scales, axes and descriptive labels
- Unit 4.2.10 Read and interpret simple tables and graphs, using reasoning to draw simple inferences from beyond the data
- Unit 4.2.11 Critically evaluate simple tables and graphs for misleading information; for example, scale starting at 50 instead of 0
- 4.2.12 Understand and use the three forms of average – mean, mode and median, in straightforward everyday contexts
- 4.2.13 Determine whether a prediction or inference is reasonable in probability and statistics contexts
- 4.2.14 Communicate information (oral and written) about probability and statistics using language and symbols consistent with the context

Australian Curriculum Link

- ACMSP047 Identify practical activities and everyday events that involve chance. Describe outcomes as 'likely' or 'unlikely' and identify some events as 'certain' or 'impossible'
- ACMSP067 Conduct chance experiments, identify and describe possible outcomes and recognise variation in results
- ACMSP092 Describe possible everyday events and order their chances of occurring
- ACMSP116 List outcomes of chance experiments involving equally likely outcomes and represent probabilities of those outcomes using fractions
- ACMSP117 Recognise that probabilities range from 0 to 1
- ACMSP118 Pose questions and collect categorical or numerical data by observation or survey
- ACMSP119 Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies
- ACMSP120 Describe and interpret different data sets in context
- ACMSP144 Describe probabilities using fractions, decimals and percentages
- ACMSP168 Assign probabilities to the outcomes of events and determine probabilities for events
- ACMSP169 Identify and investigate issues involving numerical data collected from primary and secondary sources
- ACMSP170 Construct and compare a range of data displays including stem and leaf plots and dot plots
- ACMSP171 Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of the data
- ACMSP172 Describe and interpret data displays using median, mean and range

Topic 1

Probability

Mathematics Discussion

Probability is used in everyday situations to describe and measure chance events.

We can describe the probability of an event happening, such as whether it will rain, using words such as impossible, slight chance, likely, fifty-fifty, highly probable and certain. We can also use probability to order events from most to least likely to occur, or vice versa. This helps us to predict the likelihood of a particular event, giving us a means to plan for particular outcomes.

We can also use numbers to describe probability using a number line continuum, with 0 (or 0%) meaning impossible, and 1 (or 100%) meaning certain to happen.



Probability can be represented using fractions, decimals and percentages. Therefore, the probability of a tail when you toss a coin can be written as $\frac{1}{2}$, 0.5 or 50%. This is because there are two possible, equally likely outcomes when tossing a fair coin; heads or tails, and there is one tail. When representing probability as a fraction, the denominator represents the number of all possible outcomes and the numerator represents the number of desired outcomes. This means that each time the coin is tossed there is a one in two, $\frac{1}{2}$, chance of getting a tail. However, this does not mean that 1 in each 2 tosses of a coin will be tails. When a coin is tossed a large number of times the result will be tails about half of the time in the long run.

We can use probability to make predictions of real-life events based on their occurrences in the past by studying the data collected from surveys, trials, opinion polls etc. For example, by recording the timing of cyclones in the north-west of Western Australia, we can predict when the cyclones in this region are most likely to occur in the upcoming year.

Whole Class Activity 1

“The probable is what usually happens.” - Aristotle.

Discuss as a class, the meaning of this quote.

How do we use probability in real life? Discuss and jot down ideas in reference to:

- Weather
- Outdoor activities
- Games
- Sports
- Business decisions
- Medical decisions
- Life expectancy
- Insurance for cars, houses etc.

How do we use our knowledge of past events to make predictions of future events? Discuss with class members and jot down examples of your thinking.



Whole Class Activity 2

Think: How can we describe, compare and order the likelihood of everyday events occurring?

Tom from Melbourne, Australia, Indiri from New Delhi, India, and Petrov from St Petersburg, Russia, were all describing the chance of rain occurring in their home cities on a particular day in April. Tom described the chance of rain as *certain*, Indiri described it as *an even chance* and Petrov described it as *highly unlikely*.

Brainstorm with your classmates other words and phrases that could be used to describe the chance of rain on a particular day. List the ideas, together with *certain*, *even chance* and *highly unlikely*, in the space below:

Circle 8 words or phrases from your list above. Rank them in order from least likely to most likely in the space below.

The statements below are used to describe weather conditions on a particular day. Choose the best term from the box above to match each statement on the basis of the likelihood of it raining on that particular day.

- a) Cool and cloudy
- b) Hot and sunny
- c) Cold and hailing
- d) A 15 C day in Perth in winter
- e) Warm with a cool breeze

List the events a – e in order from least likely to rain to most likely to rain.



How would the phrases you matched to these weather conditions change, if you were asked to order them on the basis of the likelihood of it snowing on that particular day?



How would the phrases you matched to these weather conditions change, if you were asked to order them on the basis of the likelihood of you wearing bathers or swimmers on that particular day?



How can describing an event using words such as impossible, unlikely, even chance, likely and certain help us to order the likelihood of that event happening?



Practice Exercise 1

1. Sort the statements below into the best box.

IMPOSSIBLE

UNLIKELY

EVEN CHANCE

LIKELY

CERTAIN



- i) There are more right handed people in this room than left handed
- ii) A girl in our class will be 2 m tall
- iii) The sun will set in the east
- iv) The price of milk will be higher next year
- v) Everyone in this room is alive
- vi) People in our class will have a mobile phone

- a) Which event is most likely?
- b) Which event is least likely?
- c) Which event is closest to being an even chance?

2. Choose one of the words below to describe the likelihood of drawing a green block from a bag filled with each of the following:

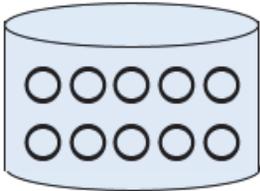
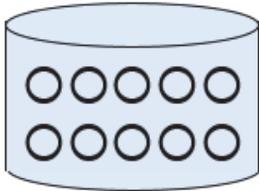
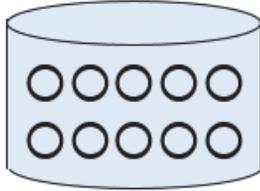
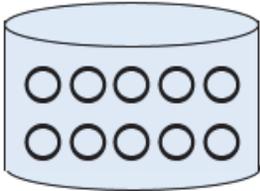
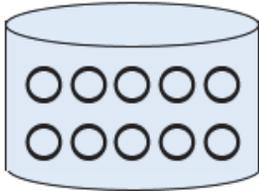
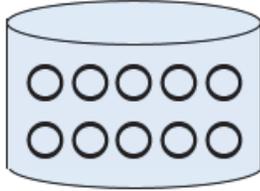
Impossible, Highly Unlikely, Unlikely, Even Chance, Likely, Highly Likely, Certain

- a) 10 red blocks
- b) 8 green blocks and 2 red blocks
- c) 1 green block and 9 red blocks
- d) 5 green blocks and 5 red blocks
- e) 10 green blocks
- f) 2 green blocks, 2 white blocks and 6 red blocks

3. Order the events above from the least chance of drawing a green block to the most.

4. The following containers represent jars of Smarties™.

a) If you were drawing out a Smartie™ from the jar, colour the Smarties™ so that:

<p>A. You would be certain to get red.</p> 	<p>B. The chance of getting red would be highly likely.</p> 	<p>C. The chance of getting red would be less than blue but more than yellow.</p> 
<p>D. You would be more likely to get blue than red.</p> 	<p>E. The probability of getting red would be fifty-fifty.</p> 	<p>F. The probability of getting red would be twice that of getting blue.</p> 

b) Order events A – F from least likely to draw out red to most likely to draw out red.

Games for Practicing:

Download the following website to play the BASIC PROBABILITY PRACTICE and PULLING OBJECTS FROM BAG games relating to probability:

<http://www.free-training-tutorial.com/probability-games.html>

Whole Class Activity 3

Think: How can we describe the chance of an everyday event occurring using numbers?

In Whole Class Activity 1 you were asked to rank words or phrases used to describe the likelihood of an event happening. Copy these words in the space below and label the word or phrase that is least likely 'A', through to the most likely 'H'.

In probability, we use 0 to describe events that are impossible. We use 1 to describe events that are certain to happen. All other probabilities lie between 0 and 1. On the number line below, work with your classmates to place the events 'A' through to 'H'.



On your own, develop and label a scale on the number line above, next to each marker. For each letter below, write a number that matches the event.

A - _____, B - _____, C - _____, D - _____, E - _____, F - _____, G - _____, H - _____.

Did you use fractions, decimals or percentages on your scale to describe each letter above? Why? Compare your answers with your classmates. Did any of your classmates use a different type of number?



Probability can be described using fractions, decimals or percentages. Use the number line above and your knowledge of converting between these different forms of numbers, to complete the following table.

NUMBER FORM	A	B	C	D	E	F	G	H
Fraction								
Decimal								
Percentage								

Which word or phrase corresponds to a probability of 0?

Which words or phrases mean *nearly* having a probability of 0?



Which word or phrase corresponds to a probability of 1?

Which words or phrases mean *nearly* having a probability of 1?



Which word or phrase corresponded best to a probability of 0.75?

Compare your answer with other class members. Justify your response.



The weather bureau gave the chance of rain in Melbourne as 0.9, the chance of rain in New Delhi as $\frac{2}{5}$ and the chance of rain in St Petersburg as 25%. Order these cities according to their chance of rain from least likely to most likely.



Are the predictions from the weather bureau given above, more or less than Tom's, Indiri's and Petrov's predictions on page 52? Justify your answer.



If an outdoor sporting event was going to be held on the same day in Melbourne, New Delhi and St Petersburg, how could you use the probabilities of rain in each of the cities to decide whether the event should go ahead or be cancelled?

In which cities was it easy to decide? In which cities was it hard to decide? Justify your answer.



Practice Exercise 2

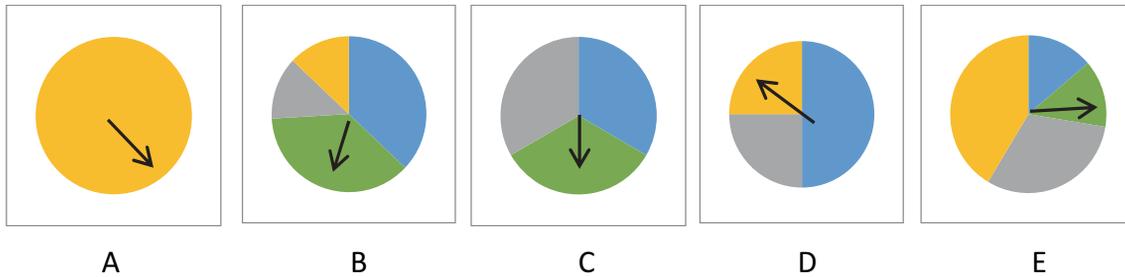
1. Describe the probability of each event below by putting a letter in the correct position on the number line.

- A. Drawing a red card from a standard pack of playing cards
- B. The temperature in Perth being above 10 in January
- C. Arriving at school more than 5 minutes before it starts
- D. Your Mathematics teacher reading 'Harry Potter' to you in class
- E. Rolling a 2 or 3 on a normal six sided dice
- F. Raining in May in Busselton



Use the scale on the number line to assign a numerical probability to each of the events A to F. Write the probabilities as fractions.

2. Position the letters of each spinner on the number line according to its chances of landing on yellow



Use the scale on the number line to assign a numerical probability to each of the spinners A to E. Write the probability of the arrow landing on yellow for each spinner as a percentage.

A. B. C. D. E.

3. Select a probability from this list that most likely matches the following events:

1.0 0.5 0.25 0.00001 0.9 0.1

Getting a tail when you toss one coin once.

Getting your license before you are 20.

Getting a 'Friend' request on Facebook this evening.

The sun setting this evening.

Getting two tails when you toss two coins.

Winning first prize in a raffle where 100 000 tickets are sold.

4. Draw a line to connect the likelihood of drawing a blue marble from a bag, with its best word description and then the number that best reflects that probability.

Bag Contains:	Word Description	Number
Many blue marbles and two red marbles	unlikely	$\frac{1}{100}$
No blue marbles	highly unlikely	1
The same number of blue as red marbles and no other coloured marbles	a certainty	85%
One blue marble and 99 red marbles	fifty-fifty	0.333333
Twice as many red marbles as blue and no other marbles	impossible	0
All blue marbles	highly likely	50%

Whole Class Activity 4

Think: How can listing all the possibilities of an event occurring help us describe the chance of that event happening?

Tom from Melbourne and Indiri from New Delhi were playing an online, interactive board game. The game involved tossing a simulated coin and rolling a simulated dice. A 'tail' means move left and a 'head' means move right. 'Tail, 5' means moving left, 5 places, while 'Heads, 3' means moving right, 3 places. They start the game after they roll a 'Tail, 6' or a 'Head, 6'.

Tom wondered what the probability of getting a 'Tail, 6' or a 'Head, 6' was?

Listing all the possible outcomes of events occurring is called a *Sample Space*. Write the sample space for tossing a coin and rolling a dice (eg. Tail, 5)



How many different possibilities are there?



How many of the possibilities are 'Tail, 6' or 'Head, 6'?



Use the definition of numerical probability:

$$P(\text{event}) = \frac{\text{Number of Successes}}{\text{Total Number of Outcomes}}$$

to calculate the probability of a 'Tail, 6' or 'Head, 6' occurring.



Find the probability of the following events occurring:

- (i) Heads, 3
- (ii) Tails, even number
- (iii) Heads or Tails, odd number
- (iv) Not getting a 3

The chance of getting a 'Tail, 2' is $\frac{1}{20}$. This can also be described as 'one chance in 20'. Does this mean that in 20 tosses and rolls, you will get exactly one 'Tail, 2'? Explain your thinking.



Complete the following table:

Questions	Sample Space	Number of Successes	Probability
What is the probability of getting a tail on a single toss of a coin?			
What is the probability of getting a 4 on a single roll of a dice?			
What is the probability of drawing a diamond from a pack of cards?			
If each letter of RUSSIA was written on a piece of paper, what is the probability of drawing a vowel?			

Practice Exercise 3

1. List the sample space for rolling a normal 6 sided dice and calculate the probability of getting:

- a) A 6
- b) A 3
- c) An odd number
- d) A number bigger than 4
- e) A number less than 1
- f) Not a 5

2. a) List the sample space of heads and tails when tossing a 50c piece and a \$1 coin at the same time, once.

b) Place the following events in the correct spot on the number line.

- A. Two heads occurring
- B. A head and a tail
- C. At least one tail
- D. Neither a head nor a tail on either coin



c) Write the probability of each event occurring as a fraction, decimal and percentage.

Event	Fraction	Decimal	Percentage
A			
B			
C			
D			

d) Write the events in order from least likely to occur to most likely to occur.

3. List the sample space that occurs when writing all the letters of the alphabet on separate pieces of paper. Imagine the pieces of paper are placed in a bag. Find the probability of randomly choosing:

- a) An 'A'
- b) A consonant
- c) A 'P' or a 'Q'
- d) A letter from the word MATHS
- e) A letter from the word JAKARTA
- f) Not a vowel

4 a) List the sample space for a pack of cards in the space below.

What is the probability of drawing from a pack of cards:

- a) A black card
- b) A 7
- c) A King
- d) A number card
- e) A picture card

5. In your Maths class, 6 people (including you) forgot to put names on their maths paper. The teacher decided to allocate the following percentages to those 6 people;

90%, 45%, 50%, 50%, 37%, 85%.

What is the probability you will be given a score of:

- a) 45%
- b) 75%
- c) 50%
- d) 90% or less
- e) less than 50%
- f) a percentage that was NOT 50%

Games for Practicing

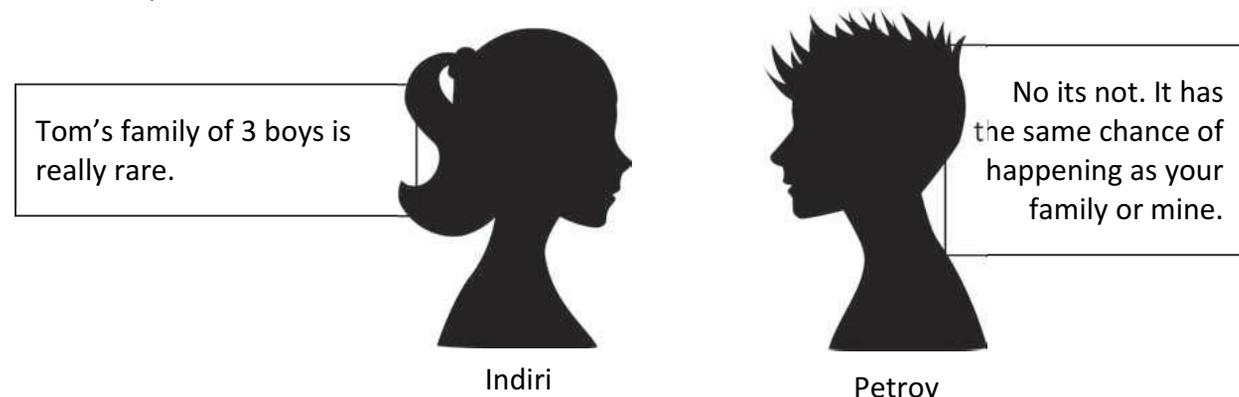
Download the following website to play the BALL PICKING MACHINE, COCO THE PARROT, and PROBABILITY CIRCUS games relating to numerical probability:

<http://www.free-training-tutorial.com/probability-games.html>

Whole Class Activity 5

Think: How can we predict the likelihood of familiar events happening, based on past experience or data?

Tom, Indira and Petrov had all met on an online weather forum. They soon discovered they each belonged to a 3 child family. Tom belonged to a family of 3 boys, Indira to a family of two older girls and then a boy and Petrov belonged to a family where he was the eldest, then a sister, followed by a brother.



What is the chance of a 3 child family being all boys? What is the chance of a 3 child family being two girls then a boy or a boy followed by a girl then a boy? Is Indiri correct or Petrov? Justify your answer.



Work with a partner to conduct the following experiment to simulate a 3 child family.

EQUIPMENT

1. A coin to toss or use a coin tossing simulator on a phone app such as 'Coin & Dice' by Okamistudio.com
2. Pen and paper to record the outcomes.

EXPERIMENT

1. Use a 'head' on a coin toss for a girl and a 'tail' for a boy.
2. Toss the coin 3 times to represent a 3 child family.
3. Decide on a way of recording the results of the 'families' (e.g. Boy, Girl, Boy or BGB).
4. Decide upon a way of systematically recording multiple tosses.
5. Toss the coin to represent at least 40 'families' and record your results.

Describe the results of your data.



Based on your results, what is the chance of a 3 child family being 3 boys?

What is the chance of a 3 child family being two girls then a boy?

What is the chance of a boy followed by a girl then a boy?

Were your predictions correct? Why or why not?



Who was correct, Indiri or Petrov? Explain your thinking.



Use the results of the experiment and your knowledge of probability to predict:

1. In 8 000, 3 child families, how many of those would have 3 boys?
2. In 8 000, 3 child families, how many of those would have 2 girls followed by a boy?
3. In 8 000, 3 child families, how many of those would have a boy, then a girl, then a boy?
4. Repeat questions 1 – 3 but with a million families.
5. Repeat questions 1 – 3 but with 6 families (this may require class discussion to answer).

Practice Exercise 4

1. When a drawing pin is tossed it can land two different ways, either on its side or on its head, as shown.



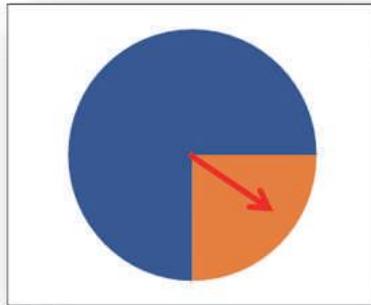
- a) Are the chances of the pin landing on its head and on its side equally likely? Explain your thinking.
- b) Predict the chance of the drawing pin landing on its side.
- c) Predict the chance of the drawing pin landing on its head.
- d) Toss a drawing pin 10 times and record whether it lands on its side or on its head in the space below.
- e) What percentage of the tosses landed on heads? Toss 40 more times and use a tally to record the results in the table below:

HEAD	
SIDE	

- f) What percentage of the tosses landed on heads?
- g) Use the data to estimate the probability of the drawing pin landing on heads.
- h) Did this match your prediction? Why/why not?
- i) Use the data to estimate the probability of the drawing pin landing on tails.
- j) Did this match your prediction? Why/why not?
- k) If you were to toss the drawing pin 60 times; 1 500 times; 10 000 times; how many times would you expect it to land on heads?
- l) If in the first toss, the drawing pin landed on its head, what is the chance that it will land on its head in the next toss?

2. SPINNER 1

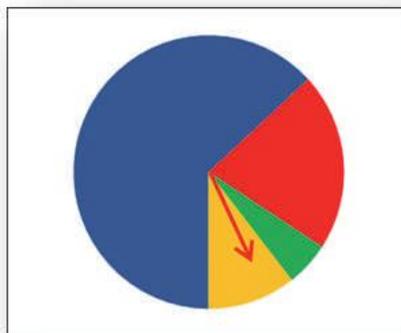
- a) If you spin this spinner, would you have as much chance of obtaining orange as blue? If not, which colour is more likely to occur? Explain your answer.



- b) Are you certain of obtaining at least one orange in:
(i) 5 spins? (ii) 10 spins? (iii) 100 spins
- c) Is it likely that you will not spin any oranges in 100 spins?
- d) Is it possible to never spin a blue in 10 spins?
- e) In 100 spins, how many times would you *expect* it to land on blue?

SPINNER 2

- f) If you spin the spinner below, would you have the same chance of obtaining yellow as red? If not, which colour is more likely to occur, red or yellow? Explain your answer.



- g) Are you certain of obtaining at least one green in:
(i) 10 spins? (ii) 100 spins? (iii) 1000 spins?
- h) Is it likely that you will not spin any yellows in 100 spins?
- i) Is it possible to never spin a blue in 10 spins?
- j) In 1000 spins, how many times would you *expect* it to land on blue?

3. Lotto is a game many people around the world play. The most common form of Lotto in Australia is based on a machine randomly choosing numbers from a pool of 45 numbers. 8 balls in total are randomly selected from the machine; 6 main numbers and 2 supplementary numbers. The largest amount of money is paid to the winner who gets the first 6 numbers drawn. The next highest amount of money is paid to the winner who gets 5 main numbers, plus a supplementary etc.

- a) What is the probability of 21 being drawn?
- b) What is the probability of it NOT being 21?
- c) If there have been 3 000 Saturday night Lotto's played, how many times would you expect 21 to have been drawn?

Use a search engine to view 'Number draw frequency for Australian Saturday Lotto Numbers' on the following website:

Historic Lottery Statistics - Lotto, Powerball, Oz Lotto & Pools

<https://www.ozlotteries.com/lottery-statistics>

- d) Which number has come out the most often?
- e) Does this number have more chance in a Lotto draw than other numbers?
- f) Which number has come out the least times?
- g) What is the probability that this number will be drawn out of the barrel in the next draw?
- h) Is it best to pick the (i) numbers that have been drawn out a lot (ii) the numbers that haven't been drawn out much (iii) it doesn't matter?
- i) Natalie always chooses the numbers 1, 2, 3, 4, 5, 6 for her Lotto numbers. Isabel always chooses a random 6 numbers and Fiona chooses the date of the birthdays of her 6 cousins. Who has the best chance of winning? Justify your answer.

4. The Australian Institute of Health and Welfare released the *2013 National Drug Strategy Household Survey with the following results concerning the percentage of daily smokers in Australia.*

Daily smokers aged 14 years or older from 1991 to 2013

YEAR	1991	1993	1995	1998	2001	2004	2007	2010	2013
TOTAL %	24.3	25.0	23.8	21.8	19.4	17.5	16.6	15.1	12.8

- a) If a person was selected at random from a large concert in 2004, what is the probability that they would smoke daily?
- b) How many people at a 1 000 person concert in 2004, would you predict, smoked on a daily basis?

- c) If a person was selected at random from a large concert in 2013, what is the probability that they would smoke daily? If there were 12 000 people at this concert, how many would you expect smoked daily?
- d) Use the trend in the data to predict the probability of a smoker being randomly chosen to participate in a health survey conducted in Hay St Mall in Perth in 2016. If 1 500 people were asked to participate in this survey, how many would smoke daily, based on your prediction?

Reflection on Learning

Draw a line to connect each event below, with its numerical probability and then the number of times you would expect the event to occur in 1 000 instances.
Order the events from least likely to most likely to occur.

EVENT	PROBABILITY	OCCURENCES IN 1 000 INSTANCES
A. Getting to work on time	25%	200
B. If it rains on average 6 days in September, what is the chance of it raining in September	0.00000000001	750
C. Getting at least one tail when tossing two coins	16.66%	500
D. The average maximum temperature in Perth in January exceeding 25	$\frac{6}{30}$	900
E. The chance of red occurring on this spinner 	0.5	0.00000001
F. Rolling a 6 to start a board game	$\frac{3}{4}$	800
G. Having a boy and a girl in a 2 child family	90%	250
H. Winning Division 1 Lotto	0.8	167

OLNA Practice Questions

1. In winter, about 0.15 of the town's population of Port Sorthy can expect to catch influenza. If Katie lives in this town, which of the following best describes Katie's chance of getting influenza?

A. Highly likely B. An even chance C. A slim chance D. Almost no chance

2. There are 40 marbles in a bag. Ten marbles are yellow and the rest are green. Jalen picks a marble from the bag without looking.

What is the chance of Jalen picking a **green** marble?

A. 0.25 B. $\frac{1}{3}$ C. 30% D. 75%

Topic 2

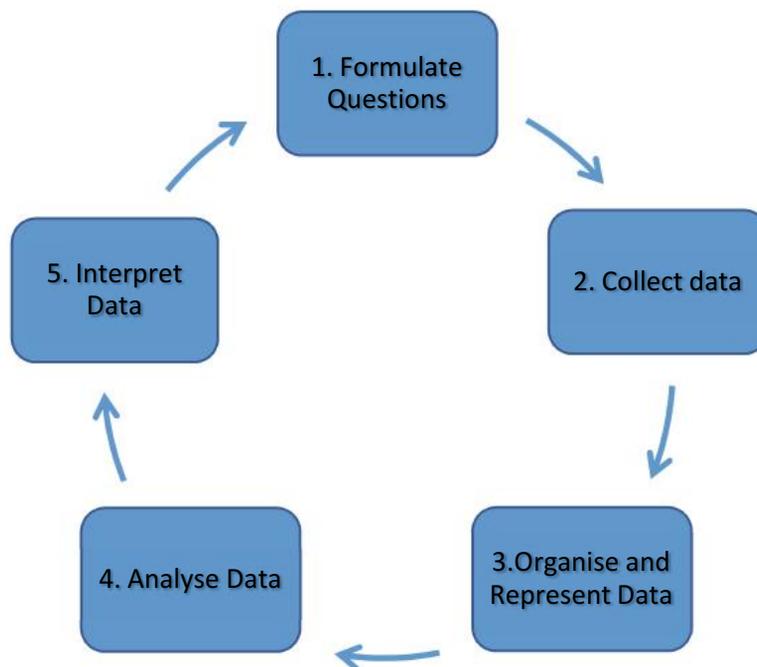
The Statistical Process using Primary Data

Mathematics Discussion

In this topic, we will be working through the statistical process using primary data. Primary data is data that is observed or collected directly from first-hand experience. It can be gained through surveys, experiments or simulations and typically involves counting or measuring responses.

The two types of data we will be focussing on are categorical data and numerical data. Categorical data is data that can be sorted into groups. For example, gender, colour of cars in a car park and favourite take away foods. Numerical data usually involves measurement, such as a person's height or a count such as the number of teeth a cat has.

In this topic we will be investigating scenarios using the *statistical investigation process*. This process can be illustrated using the following diagram



The statistical process starts with a question that can be answered by data. Data is collected to answer the question using a variety of means such as observation, or surveys. The data is then organised and represented in a way that makes it easy to see the results, using diagrams (e.g. arrow diagrams, Venn diagrams), tables or graphs (e.g. dot plots, bar graphs, line graphs). The data is analysed to decide what it means in relation to the question and then interpreted in relation to the initial question. Sometimes we work out percentages and 'averages' such as mean, mode and median in order to help us analyse and interpret the data.

Sometimes the data answers the initial question, whereas at other times, it may result in more questions being asked, requiring further investigation and so the process may continue.

Clearly and accurately communicating the findings in a statistical investigation is an important part of the statistical process.

Whole Class Activity 1

Think: How can collecting and recording data help answer questions?

Scenario: Students often do casual work whilst studying. What type of casual work and how much casual work is common in your class?

As a class, break this into two questions that could be investigated. One about the type of casual work and one about the amount.

-
-

Would the collected data be categorical or numerical? Justify your answer.



How would you record the data as you collect it? Discuss with your classmates. How did you decide what categories or numbers to use in your recording system? Show the recording systems in the space below.



Collect the data and record in your system above.

Reflect upon your questions and way of recording the data. Do any changes need to be made to your questions in order to get better data? Discuss.



Practice Exercise 1

1. For each of the following scenarios:

Circle the scenarios in blue that require collecting **categorical** data.

Circle the scenarios in red that require collecting **numerical** data.

- a) Did you watch TV last night?
- b) What number gets rolled most often when you throw a dice?
- c) How long can a typical Year 12 student stand on one foot with their eyes closed?
- d) How far can we throw a tennis ball?
- e) What is the most common eye colour in your classroom?
- f) How much money do you earn per week from casual employment?

2. Primary data can be collected from surveys, experiments and simulations by either counting or measuring. List the scenario(s) in question 1 that would require counting as the way of collecting data.

3. Choose 2 of the scenarios from question 1 and complete the questions in the table.

SCENARIO 1:	SCENARIO 2:
Where or from whom will I collect the data?	Where or from whom will I collect the data?
How will I collect the data?	How will I collect the data?
How much data will I collect?	How much data will I collect?
When will I collect the data?	When will I collect the data?
How will I record the data as I collect it?	How will I record the data as I collect it?

What else will I need to do before I start collecting data?	What else will I need to do before I start collecting data?
Collect the data and record it on a blank sheet of paper. Staple to the side of this page.	Collect the data and record it on a blank sheet of paper. Staple to the side of this page.

4. Are iPhones™ the most popular mobile phone used by students in your class? Design a question(s) to explore this, and collect and record your data.

Whole Class Activity 2

Think: How do I organise and represent the data collected on the type and amount of casual employment worked by people in my class?

A teacher in a Mathematics class at Rockingham SHS asked all class members “What type of casual employment do you do?” They collected the following information from the 18 people in their class.

Hospitality	Child minding	Hospitality	None	Retail	None
Child minding	Cleaning	Retail	Retail	Hospitality	None
Hospitality	None	Office work	Labouring	Retail	Labouring

TABLES

Organise the above information into a table that uses a tally system (III shows 5) to record the number students employed in each category.

You need to decide:

- What is the title of the table?
- What are the titles on the rows?
- What are the titles on the columns?

Produce the table:

Compare tables in the class. Which table clearly shows the data? What are the key features of clear tables?



DOT PLOTS

To produce a dot plot to represent the data collected from Rockingham SHS:

- Label the categories of types of employment on the line below. Ensure the categories are evenly spaced on the line.
- Draw a dot for each time data appears in that category (e.g. 'Labouring' should have 2 dots).
- Ensure the dots are evenly spaced.
- Give the dot plot a title.



Compare dot plots in the class. Which was the best dot plot? Explain your choice.



A survey on types of casual employment was taken on *all* students at Rockingham SHS. Would a dot plot be a good way of representing this data? Explain your thinking. What type of data is best suited to dot plots?



Produce a dot plot in the space below of the data collected from YOUR class concerning types of casual employment worked.



COLUMN AND BAR GRAPHS

In the 'Collecting, Representing and Analysing Data' Topic in Unit 1 of the Foundation Mathematics course, characteristics of good column and bar graphs were listed. Revisit this topic or use a search engine to view 'Images of Bar and Column Graphs' to decide and make a list of the key features of good, clear graphs.



HAND DRAWN GRAPHS

On a blank sheet of paper, use a ruler to draw a horizontal and vertical axis and create a column graph of the data above showing the types of casual employment of students from Rockingham SHS, ensuring all key features are included.

You need to decide:

- What is the title of the graph?
- What is the title on the horizontal axis?
- What is the title on the vertical axis?
- What numbers or categories go on the horizontal axis?
- What numbers or categories go on the vertical axis?
- What is the largest number that needs to be included on the graph? (Use this information to decide on the scale for your axis.)

Use a ruler to mark off the numbers needed for your axes.

Use a ruler to draw each of the columns.

Label all key features on the graph.

Compare column graphs in the class. Which graph clearly shows the data? Why?



How is a column graph different to a bar graph? Explain.



How would the key features on your graph change if a survey on types of casual employment worked was taken with *all* students from Rockingham SHS?



Produce another column or bar graph of the data collected from YOUR class concerning types of casual employment.

Staple your graph to the side of this page

COMPUTER GENERATED GRAPHS

Computer generated graphs can be drawn using programs such as Excel. Work together as a class to design an efficient spreadsheet and graph to represent the data collected from Rockingham SHS. Use the following process to guide you. (NOTE: these instructions may vary slightly according to the type of computer and program used.)

- a) Open a new spreadsheet workbook and enter the title of the spreadsheet.
- b) Decide on the layout of the spreadsheet.
- c) Decide on the titles of the headings on the columns or rows.
- d) Enter the data on the types of casual employment worked by students at Rockingham SHS.

- e) Highlight all information entered on the spreadsheet.
- f) Select 'Insert' and choose and enter 'Column' graph.
- g) Select '2-D Column'. A graph should appear to the right of the table on the spreadsheet workbook.
- h) To alter the titles or axes on the graph, enter 'Layout' and then highlight what needs to be changed on the graph to clearly show all key features.
- i) Investigate altering colour of columns, axis labelling, font of title etc.

Complete the graph and save by selecting *Save As* from the *File* menu and entering the file name. Print the graph.

Compare column graphs in the class. Which was the best graph? Why?



Compare this column graph with the hand drawn graph from the previous exercise. Which is better? Which was harder to produce? Explain your thinking.



Select 'Insert' and choose 'Bar Graph'. How is a bar graph different from a column graph?



Select 'Insert' and choose 'Pie' and then '2-D Pie' to produce a pie graph. Experiment with generating other, more unusual graphs. Print your graphs and staple to the side of this page.

Which graph is the best way of showing the data collected from 'Types of Casual employment worked by students in a Foundation Mathematics class at Rockingham SHS'? Explain your thinking.



Produce a computer generated bar graph of the data collected from YOUR class concerning types of casual employment. Save the graph and print. Compare this graph with those generated for Rockingham SHS students. What is different? What is the same?



Staple your graph to the side of this page.

Practice Exercise 2

- In Whole Class Activity 1, data was collected on the **number** of hours worked by students in your class. Use this data to produce:
 - A table of the results (this may require discussion with your teacher about how best to organise the table).
 - A dot plot.
 - A hand drawn bar graph.
 - A computer generated pie graph.
 - Which of these representations makes it easy to see how the number of hours worked by students in the class varied?

- Choose and produce by hand or computer, an appropriate graph or diagram to clearly represent each of the following sets of data (choose from column graphs, multiple column graphs, bar graphs, pie graphs, or Venn diagrams).

Note: In some examples it will be necessary to produce a table of the data first.

- How many times each number occurred when rolling a 6 sided dice, 30 times.

Number on dice	1	2	3	4	5	6
Total occurrences	6	3	5	2	5	9

- Favourite colour of 25 teenagers:

BLUE, GREEN, YELLOW, BLUE, RED, PURPLE, GREEN, WHITE, WHITE, BLACK, BLUE, RED, WHITE, BLACK, RED, BLUE, GREEN, PURPLE, PINK, ORANGE, BLUE, YELLOW, ORANGE, BLACK, BLUE.

- Preference for chocolate or vanilla icecream of 20 kindergarten students:
CHOCOLATE, BOTH, NEITHER, CHOCOLATE, VANILLA, BOTH, BOTH, VANILLA, VANILLA, BOTH, CHOCOLATE, BOTH, VANILLA, BOTH, BOTH, BOTH, CHOCOLATE, BOTH, NEITHER, VANILLA.

- Number of males (M) and females (F) in each year at Foxborough SHS.

Year Group	7		8		9		10		11		12	
Gender	M	F	M	F	M	F	M	F	M	F	M	F
Number	42	64	50	54	62	56	51	48	63	66	48	49

e) Household weekly expenses for the Kerrigan family:

rent \$550 food \$300 electricity \$70 phones \$100 gas \$15 petrol \$40
entertainment \$100 insurance \$25 clothing \$40 miscellaneous \$80

f) Ages of people at an Under 18 Music festival in the South West of Western Australia.

Age	13	14	15	16	17	18
Number	21	35	68	96	73	32

3. a) Produce a computer generated line graph to show the weight gain of an Australian boy from birth to 12 months.

Time in Months	BIRTH	1	2	3	4	5	6	7	8	9	10	11	12
Weight in Kg	3.5	4.3	5.2	6	6.6	7.1	7.5	7.8	8.2	8.6	9.1	9.4	9.6

b) Why is a line graph the best graph to choose for this data? Explain. (You may wish to refer back to Foundation Mathematics Unit 1, Topic 1 on 'Collecting, Representing and Analysing Data').

4. In Practice Exercise 1, Question 4, data was collected from your class concerning types of mobile phones used by class members. Choose and produce a table, graph or chart to best represent this data.

Whole Class Activity 3

Think: How do I summarise and analyse the data collected?

TYPES OF EMPLOYMENT - CATEGORICAL DATA

Categorical data on the type of casual employment worked by the 20 students in a Mathematics class at Trandiville College was collected and recorded in the following table:

Type of Employment	Retail	Childcare	Labouring	Hospitality	Sport & Recreation	None
Number	1	4	1	5	6	3

From this table, we can reach the following conclusions:

- Most students were employed in hospitality or sport & recreation.
- 20% of students were employed in childcare.
- $\frac{3}{20}$ students did no casual work.

Write 3 more conclusions you can draw from this data:

-
-
-

How can using fractions or percentages, obtained from the data, help to analyse the information collected?



What were the most important facts to arise from this analysis of the data? Why?



NUMBER OF HOURS OF EMPLOYMENT - NUMERICAL DATA

Data on the number of hours worked by students in a Mathematics class at Trandiville College was collected and recorded in the following table:

Number of hours	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	25
Number of students	3	0	0	1	2	4	4	1	1	0	1	1	0	1	0	1

From this table, we can reach the following conclusions:

- 3 students did not do any casual work.
- The most hours any student worked was 25.
- 10% of students did 4 hours of work.

Write 3 more conclusions you can draw from this data:

-
-
-

We can also summarise numerical data, using the 'averages' or 'typical value' that represents the data. These are commonly called the MEAN, MODE and MEDIAN.

- **MEAN** is calculated by adding all the scores together and dividing by how many scores there are. i.e.

$$\frac{0 + 0 + 0 + 3 + 4 + 4 + 5 + 5 + 5 + 5 + 6 + 6 + 6 + 6 + 7 + 8 + 10 + 11 + 13 + 25}{20}$$

The mean number of hours worked is:



- **MODE** is the most frequently occurring number of hours (NOTE: the MODE can be bimodal – i.e. two scores occur most often)

The modal (mode) number of hours worked is:



- **MEDIAN** is the middle score when the scores are arranged in order from smallest to largest. If there are two scores in the middle the median is calculated by finding the mean of the two middle scores.

The median number of hours worked is:



What does the mean, mode and median tell you about the number of casual hours worked by students at Trandiville College?



Fully analyse the data from YOUR class on the number of casual hours worked by class members. What was the 'average' number of hours worked by students in your class?



Practice Exercise 3

1. Angela asked 20 of her friends which AFL team they supported. These were the responses:

Geelong	St Kilda	Dockers	Dockers	West Coast Eagles
Carlton	Dockers	Hawthorn	Collingwood	Dockers
Collingwood	Dockers	St Kilda	Adelaide	West Coast Eagles
Hawthorn	Dockers	St Kilda	Dockers	Port Adelaide

- a) Why is this considered primary data?
- b) Organise and record the results in a table.
- c) Which team had the most supporters?
- d) What was the name of the team(s) that had one supporter?
- e) What fraction of the people asked supported Collingwood?
- f) 15% of the friends supported which team(s)?

2. Bernadette volunteered to collect donations at a local shopping centre in a tin for victims of a major fire that had occurred in the South West of Western Australia. She was interested in finding the average donation people made, so she recorded the following donations on a piece of paper as she worked:

\$10	50c	20c	\$1	\$2	\$1	50c	20c	\$5	\$2	\$1
50c	20c	\$2	\$2	\$5	10c	\$1	\$1	\$10	\$50	50c
\$2	\$1	50c	20c	\$5	10c	\$1	\$10	\$5	50c	\$1

- a) Organise and record the results in a table.
- b) What fraction of the donations was \$5?
- c) What percentage of the donations was 50c?
- d) What was the modal donation?
- e) What was the median donation?
- f) What was the mean donation?
3. As a class, collect information on the way in which students get to school.
- a) Organise and record the results in a table.
- b) What was the most popular way of getting to school?
- c) What was the least popular way of getting to school?
- d) What fraction of students walked to school?
- e) What percentage of students rode bikes to school?
- f) If a student who caught the bus to school joined the class, how would this change your answers to b – e?
4. As a class, arrange yourselves in the classroom in order from shortest to tallest. Determine:
- a) Who is the shortest student?
- b) What was the height difference between the shortest and tallest student?
- c) Who is the student with the median height? What is this median height?
- d) Is there a modal height? Explain your answer.
- e) Determine the mean height of students in your room? What calculations did you do to find this answer?
- f) If a new student with a height of 196 cm joined the class, how would this affect the mean, mode and median of your group?

5. As a class, collect information on the number of televisions in each class member's home. Organise and record the results in a table.
- How many students had 2 televisions in their home?
 - What fraction of students had 3 televisions in their home?
 - What percentage of students had 1 television in their home?
 - What was the modal number of televisions in your homes?
 - What was the median number of televisions in your homes?
 - What was the mean number of televisions in your home?
6. In Practice Exercise 1, Question 4, data was collected on types of mobile phones used by class members. This data was then represented in a graph in Practice Exercise 2, question 4. Does it make sense to calculate the mean, mode and median to analyse the data you collected in this scenario? Explain your thinking for each of mean, mode and median.

Whole Class Activity 4

Think: How do I interpret the data collected on the type and amount of casual employment worked by people in our class?

Once we have summarised the data, we can then interpret the data. This involves deciding what the data means and drawing conclusions from it. This may involve relating the data to the time the data was taken and the location it was taken from. We can then draw conclusions and identify patterns within the data and make predictions or inferences beyond the data.

INTERPRETING CATEGORICAL DATA

Type of Employment of Students at Trandiville College						
Type of Employment	Retail	Childcare	Labouring	Hospitality	Sport & Recreation	None
Number	1	4	1	5	6	3

We can analyse the categorical data in the table above it by:

Relating the data to the location it was taken in.

- Trandiville College is located next to a large Recreation Centre that has a swimming pool. It offers a lot of casual employment such as teaching swimming and umpiring. We can conclude that the Recreation Centre is important to casual employment in the area, as this employed 30% of the class.
- The school is also close to a restaurant precinct that offers employment in waitressing, food preparation etc. A quarter of the students worked in hospitality.

Relating the data to the time it was collected.

- Trandiville College is in a suburb with many young families where the need for swimming lessons, umpiring, waitressing, babysitting etc is high. 75% of students worked in these forms of casual employment.
- We can predict that in future, as the suburb 'ages', the need for casual jobs in swimming lessons and babysitting will diminish and different forms of casual employment will emerge.
- We can predict that as a shopping centre is due to be built in the coming years, employment in retail should rise.

Fully interpret and analyse the data collected from YOUR class on the type of casual employment worked by students in your class.



INTERPRETING NUMERICAL DATA

Number of Hours Worked by Students at Trandiville College																
Number of Hours	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of Students	3	0	0	1	2	4	4	1	1	0	1	1	0	1	0	1

We can analyse the numerical data in the table above by:

Relating the data to the location in which it was gathered.

- Most students were employed casually in sport and recreation due to the location of the Recreation Centre. This generally involved umpiring 3 - 4 games per week or taking 3 – 4 swimming lessons. Hence the modal number of hours being 5 and 6 and the median hours being 5.
- Most shifts in the restaurants in the area were 5 hours long, hence another reason for the mode and median.

Relating the data to the time in which it was gathered.

- Most students said they were working less hours than normal due to exams at school.

Interpreting the 'averages'

- One student worked many hours of casual work (25). This inflated the mean.
- The mode and median show that typically a student works 5 or 6 hours.

Fully interpret and analyse the data collected from YOUR class on the number of hours of casual employment worked by students in your class.



Consider the initial scenario posed at the beginning of this topic. Does the data you collected and your representation and interpretation of it answer your initial question? Explain why.



Practice Exercise 4

1. In Practice Exercise 3, questions 3, 4 and 5, data was collected, recorded and summarised. Fully analyse and interpret the data from these scenarios.

a) QUESTION 3 – Ways of getting to school of students in your class.

b) QUESTION 4 – Heights of students in your class.

c) QUESTION 5 – Number of televisions in the homes of people in your class.

2. Interpret the data on types of mobile phones used by students in your class as collected in Practice Exercise 1, question 4. How does your interpretation of this data vary from your interpretation of the data in question 1 above?

Reflection on Learning

Choose one of the following scenarios to investigate and produce a PowerPoint display on your findings:

- What sport did you play last night?
- What number gets rolled most often when you throw a 10 sided dice?
- On which day do you do the most homework?
- How far is your 'standing jump'?
- How many hours did you sleep last night?
- How much money do you earn per week from employment?
- Any other statistical situation that interests you (check with your teacher).

In your PowerPoint, make sure to include:

1. What questions you asked.
2. The record of the primary data you collected.
3. The representations of your data (tables, graphs, diagrams).
4. The summary of your data.
5. The analysis and interpretation of your data.
6. How your ideas and approach to the investigation changed as you worked through the statistical process.

Present your PowerPoint to your classmates.

OLNA Practice Questions

1. This table summarises the time Natalie spent walking the neighbour's dog over a week.

DAY	MON	TUES	WED	THUR	FRI	SAT	SUN
TIME	1 hour	47 mins	$\frac{3}{4}$ hr	53 mins	40 mins	$1\frac{1}{2}$ hrs	40 mins

What was the average (mean) time Natalie spent walking her neighbour's dog?

- A. 26.1 mins B. 40 mins C. 53.6 mins D. 58 mins
2. The following data was collected on the favourite dessert of students in Year 11 at Trandiville College.

Dessert type	Icecream	Apple pie	Fruit salad	Chocolate cake	Pudding	Lemon tart
Number of students	28	4	14	38	16	20

Which of these statements is NOT true?

- A. Most students liked chocolate cake.
- B. $\frac{1}{6}$ of all students liked lemon tart.
- C. 3.33% of all students liked apple pie.
- D. 28% of all students liked icecream.

Topic 3

The Statistical Process with Secondary Data

Mathematics Discussion

In this topic, we will be analysing and interpreting secondary data. Secondary data is data that has been collected and published by other people.

To understand secondary data, we need to read the table, graph or diagram used to represent the data; looking at the information provided, such as the headings, titles and scales on the axis etc. We need to ask 'why has this data been represented in this way?' and 'what/who was the source of this data?' Sometimes data is collected from a whole population whereas at other times it is collected from a sample of the group.

Different graphs are suitable for different types of data. For example, some data is better represented in a line graph than in a column graph, some is better represented in a histogram than a table. Some graphs provide complicated data and it can require considerable skill to read and understand all of the information. Some graphs are presented in ways to highlight a particular point, and some can be presented in a way to be deliberately misleading.

We can analyse the data provided using numerical information, for example, percentages and 'averages' such as mean, mode and median and the range. The range is the difference between the smallest and largest observations within the data.

Lastly we need to interpret the data by looking at the data itself, between the data (usually by comparing sections of data) and beyond the data (looking for trends and making inferences).

Whole Class Activity 1

Think: How do we read tables and graphs of secondary data?

SECONDARY DATA IN TABLES

The following data shows rental prices in Australind, a suburb near Bunbury in Western Australia, in the last quarter of 2015. (Reference: <http://reiwa.com.au/the-wa-market/suburb-rentals-search-results/>)

Prices of Houses for Rent in Australind WA; Results for Oct - Dec of 2015.

SUBURB	TYPE	NO. BEDROOMS	NUMBER	SUBURB MEDIAN
Australind	House	1-2	1	\$355.00
Australind	House	3	33	\$330.00
Australind	House	4	64	\$400.00
Australind	House	5+	2	\$430.00
Australind	House	ALL	100	\$380.00

What does the title of the table tell you about the purpose of the table?



What is the purpose of each of the columns?



What is the purpose of each of the rows?



Is the data in the table from the whole population or is it a sample of the group? How does the title of the table help you decide?



Read across the rows and down the columns to answer the following questions:

How many 4 bedroom houses were for rent in Australind in this time period? What was their median price?



What type of house had a median price of \$355?



What type of house was the most expensive to rent?

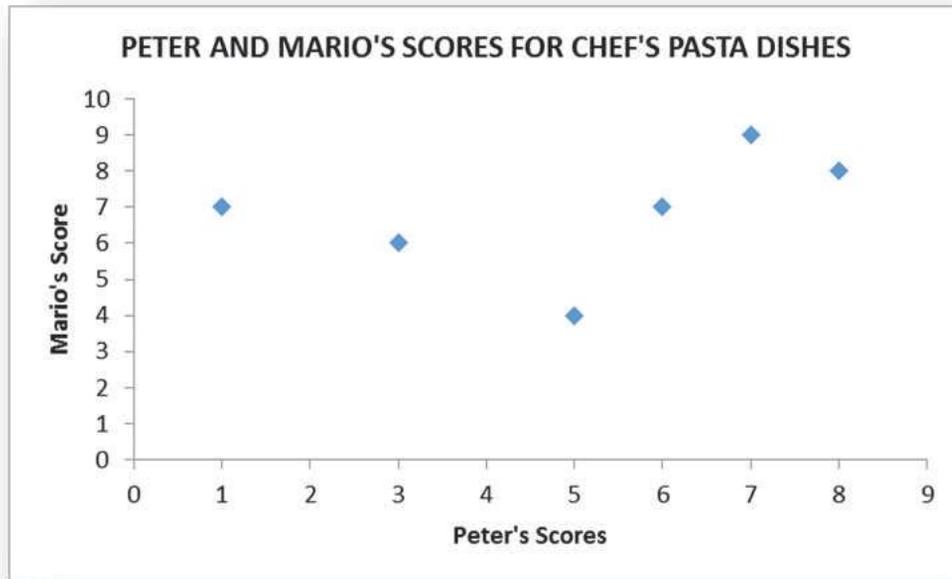


What was the most common type of house, based on the number of bedrooms?



SECONDARY DATA IN GRAPHS

A. The following graphs shows the scores (out of 10) given to the contestants on a cooking show for their pasta dish, by the two judges, Peter and Mario.



What does the title of the graph tell you about the purpose of the graph?



What are the titles of each of the axes?



What do the numbers on each axes mean?



Why did the person who made this graph choose this scale?



What does each of the 'dots' on the graph represent?



Why are the 'dots' not connected to each other?



Read the data in the graph to answer the following:

How many contestants were in the cooking contest?



Circle the chef who scored 3 from Peter and 6 from Mario.

Circle the chef(s) in red that received the lowest combined score.

Circle the chef(s) in blue that received the highest combined score.

Circle the chef in black that received the same score from both chefs.

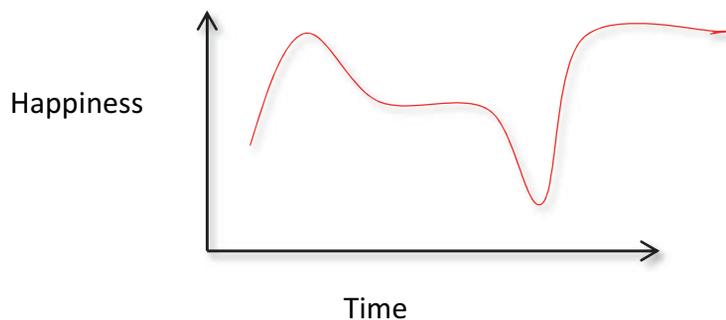
Did Peter and Mario generally agree on the score of all the contestants? Explain.



Out of the two judges, who is toughest critic? Explain your thinking.



B. The following graph shows how Elizabeth felt one Sunday between 9 am and noon.



Write a title for the graph to indicate its purpose.



What information is on each of the axes?



On the 'Time' axis, what does the data mean as you move from left to right of the graph?

On the 'Happiness' axis, what does the data mean as you move from the bottom to the top of the graph?



Why is a line used on this graph and not a series of points?



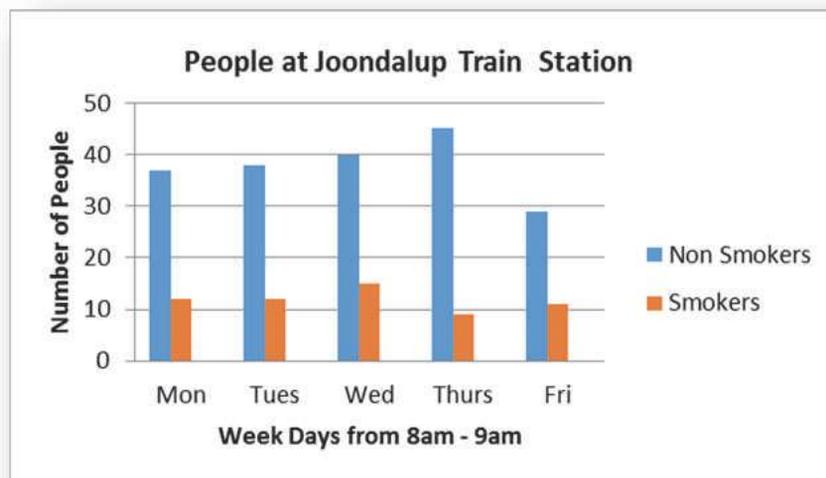
How is it possible to read the graph, given that there is no scale on each of the axes? Explain your thinking.



Read the graph and then write a paragraph to describe what could have happened during Elizabeth's day.



C. The following graph shows the number of smokers and non-smokers at Joondalup Train Station between 8 am and 9 am in the week beginning 14/3/2016.



What type of graph is this?



What does the title of the graph tell you about the purpose of the graph?

Is this the best title for this information? Discuss with your classmates.



What categories are used for the data on the horizontal axis?



What data is included on the vertical axis?



What scale is used on the vertical axis? Why was this scale chosen?



Is this data a sample or a population? How do you know?



How would the graph look different if the data was gathered in a different location, or from a different group of people?



Read the graph to answer the following questions:

How many smokers were there on Thursday between 8 am and 9 am?



On which day were there 40 non-smokers?



How many people in total were at the train station on Friday?



D. Collect a variety of secondary data presented in tables, bar, column, line, picture and pie graphs from newspapers, magazines, encyclopaedias and the internet. Select the best of each table and graph types and paste on a large sheet of paper to form a **class poster**.

As a class, discuss:

- (i) The purpose of each of the tables and graphs as suggested by the title.
- (ii) The labels on the rows and columns of the tables and the axes of the graphs.
- (iii) The scale on the axes of the graphs.
- (iv) Is the data numerical or categorical or both?
- (v) Is the data representative of a sample or a population?
- (vi) Why has the data been represented in its current form, ie, why has a table been used, or why a graph, and why the particular type of graph?

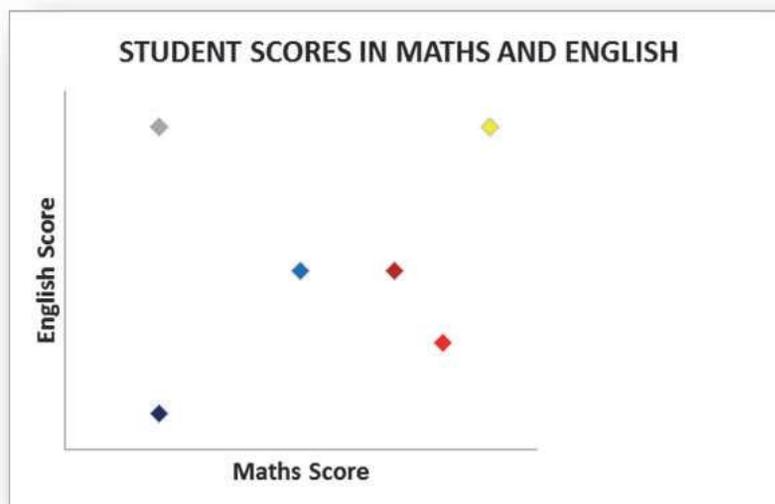
Practice Exercise 1

1. View the data shown on the following websites and answer the questions in the following table:

WEBSITE 1: http://www.afl.com.au/stats	WEBSITE 2: http://www.bom.gov.au/climate/averages/tables/cw_009225.shtml
What is the purpose of the <i>TEAM</i> table?	What is the purpose of the table for <i>PERTH</i> ?
What data is in each of the rows?	What data is in each of the rows?

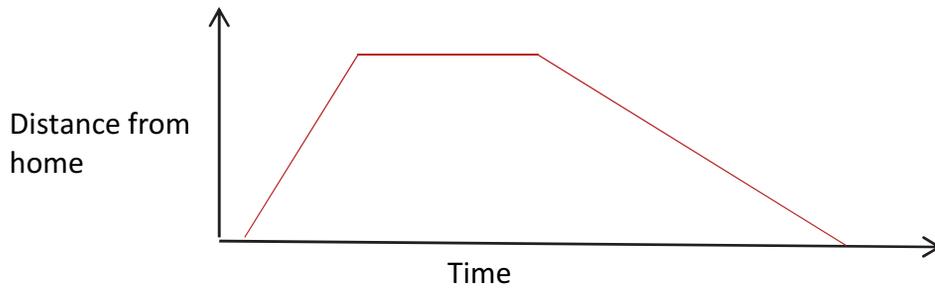
What data is in each of the columns?	What data is in each of the columns?
Is this data from a population or a sample?	Is this data from a population or a sample?
How, when and where would the data have been collected?	How, when and where would the data have been collected?

2. The following graph shows a group of students' scores out of 10 in a Maths and English test.



- Which two students got the same score in Maths?
- Which two students got the same score in English?
- Which student got the lowest score in Maths and equal highest in English?
- Which student scored well in Maths and poorly in English?
- Which student scored similar results in both Maths and English?
- Is there a relationship between scoring well in Maths and English? Should we connect the points on the graph? Explain your thinking for both questions.

2. The Robinson family went to visit relatives in Moora. The graph below shows how far they were from home at various times of the day.



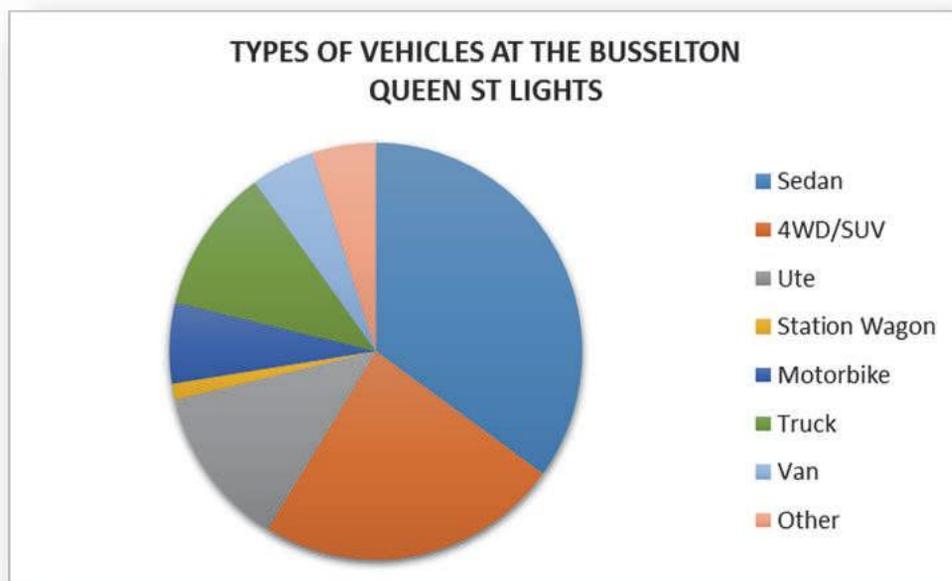
Two students, Mitchell and Brodie, explained this graph.

Mitchell: The family drove up a steep hill to their relative's house. They stayed on the flat ground of their relative's house and then drove back down a less steep road to get home.

Brodie: The family drove fairly quickly to their relative's house. They stayed quite a while before driving home at a slow pace.

Which of the two stories best matches the data in the graph? Explain your choice.

3. The following graph shows the results of observing 80 vehicles as they passed through the Queen St traffic lights in Busselton.



- What is the purpose of this graph, suggested by the title?
- What type of vehicle was the (i) most popular (ii) least popular?
- 'There were twice as many utes as motorbikes'. True or False. Justify your answer.

Whole Class Activity 2

Think: How do we organise and choose the best graph to represent secondary data?

- A. Katie, a student nurse, was preparing a report on alcohol consumption by Australians. She found the following statistics from the 'National Drug Strategy Household Survey 2013'

Alcohol Status	1991	1993	1995	1998	2001	2004	2007	2010	2013
Daily	10.2	8.5	8.8	8.5	8.3	8.9	8.1	7.2	6.5#
Weekly	41.0	39.9	35.2	40.1	39.5	41.2	41.2	39.5	37.3#
Less than weekly	30.4	29.5	34.3	31.9	34.6	33.5	33.4	33.8	34.5
Ex-drinker ^(a)	12.0	9.0	9.5	10.0	8.0	7.1	7.0	7.4	8.0#
Never a full serve of alcohol	6.5	13.0	12.2	9.4	9.6	9.3	10.1	12.1	13.8#

Statistically significant change between 2010 and 2013.
 (a) Consumed at least a full serve of alcohol, but not in the previous 12 months.
 Reference: <http://www.aihw.gov.au/alcohol-and-other-drugs/ndshs-2013/tables/>

Open a word document and reproduce the above information in a table.

Katie wanted to produce computer generated graphs of the above data but she did not want to retype the information into a spreadsheet. Use the expertise in your class or use a search engine such as Google, to learn how to transfer data from Word to a spreadsheet. Explain how Katie can transfer the data between these formats.



Transfer the data you have put in the Word document into a spreadsheet.

Which graph should Katie choose to best show the Alcohol Status of People in 2013? Why?



Produce this graph. Save, print and staple to the side of this page.

Which graph should Katie choose to best show the trend of the percentage of people drinking alcohol on a daily basis from 1991 – 2013. Why?



Produce this graph. Save, print and staple to the side of this page.

Which graph should Katie choose to best show the data on daily drinkers, weekly drinkers and less than weekly drinkers of the Alcohol Status of People over the age of 14 from 1991 – 2013? Why?



Produce this graph. Save, print and staple to the side of this page.

Katie was wondering whether any of the data in the table could be represented using a Venn Diagram. Are there any parts of the table that could be displayed using a Venn Diagram? Explain your thinking.



Compare the graphs produced by your classmates. Which were the best graphs? Which of the situations that could be equally well represented using different graphs? Why?



- B. View the graphs on the **poster** from **Whole Class Activity 1**. Choose two graphs from the poster and discuss how the data within the graphs could have been presented as a table. What would the headings on the table be? Draw the tables in the space below.



Could the two graphs have been represented using different graphs? On which other graphs could the data have been suitably presented?



Explain when it is best to use the following graphs or diagrams to represent data:

Refer to what you have learnt and the following YouTube video with its activities:

<http://ed.ted.com/on/GV5hkNIA#review>

TYPE OF GRAPH	SITUATION WHERE THIS GRAPH IS BEST USED
Line Graphs	
Column or Bar Graphs	
Circle Graphs	
Multiple Column Graphs	
Venn Diagrams	
Histograms	

Which graphs are equally effective in representing the same situation?



Practice Exercise 2

1. Choose and produce by hand or computer, an appropriate graph or diagram to clearly represent each of the following sets of secondary data (choose from - column graphs, multiple column graphs, bar graphs, pie or circle graphs, line graphs or Venn diagrams).

a) Table 2 on the Life expectancy of Females (years) at birth, of the top 10 OECD countries, in 2013 from the following website:

<http://www.aihw.gov.au/deaths/life-expectancy/#international>

b) The results from a survey at a Farmer's Market asking 100 people whether they like mangoes, strawberries or both.

	Like Mangoes	Like Strawberries	Like Both
Number of People	32	95	27

c) The data on a food label of a product such as a packet of biscuits, concerning 'percentage daily intake' of energy, protein, fat, carbohydrate, dietary fibre and sodium.

d) The height of a tomato plant over the 6 weeks.

WEEK	1	2	3	4	5	6
HEIGHT	12 cm	16 cm	23 cm	27 cm	29 cm	31 cm

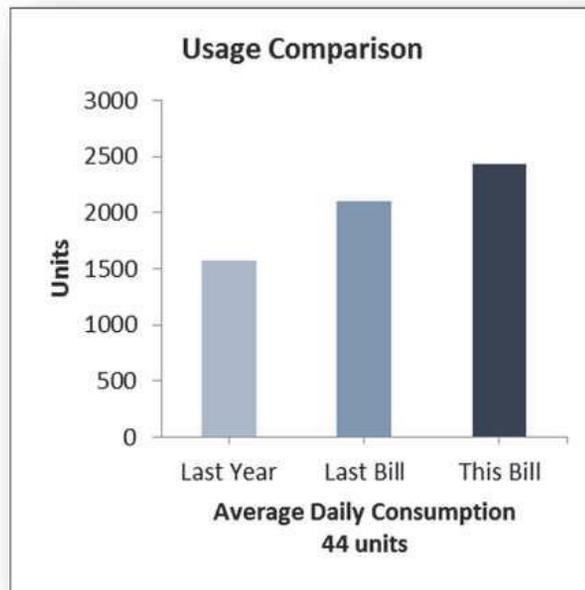
e) The statistics on Average Points, Average Rebounds and Average Assists for the top 10 players in the WNBL from the following website:

<http://wnbl.com.au/stats/>

f) The individual species daily bag limit on the number of finfish caught in West Australian waters found on the following website:

http://www.fish.wa.gov.au/Fishing-and-Aquaculture/Recreational-Fishing/Recreational-Fishing-Rules/Bag_And_Size_Limits/Pages/Nearshore-Estuarine-Finfish.aspx

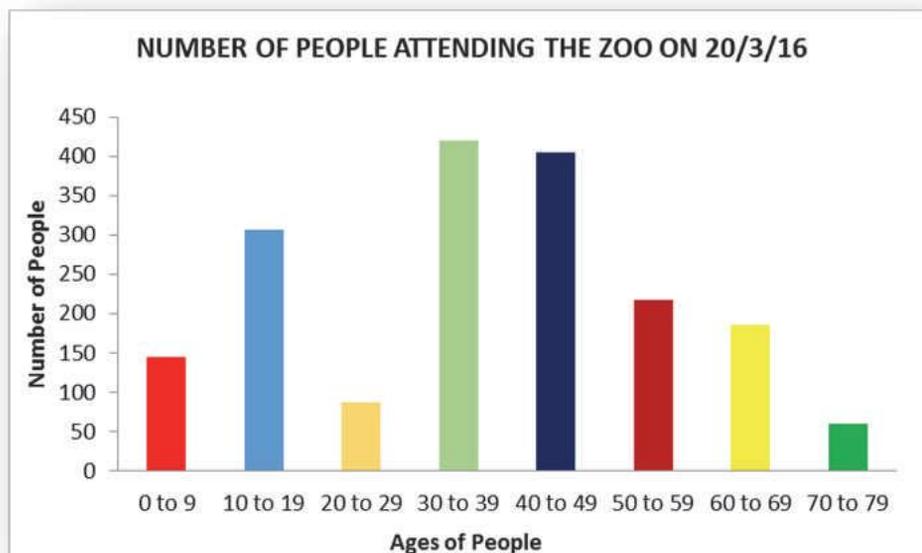
2. The following graph shows Helen's usage of electricity at 22 Smith St.



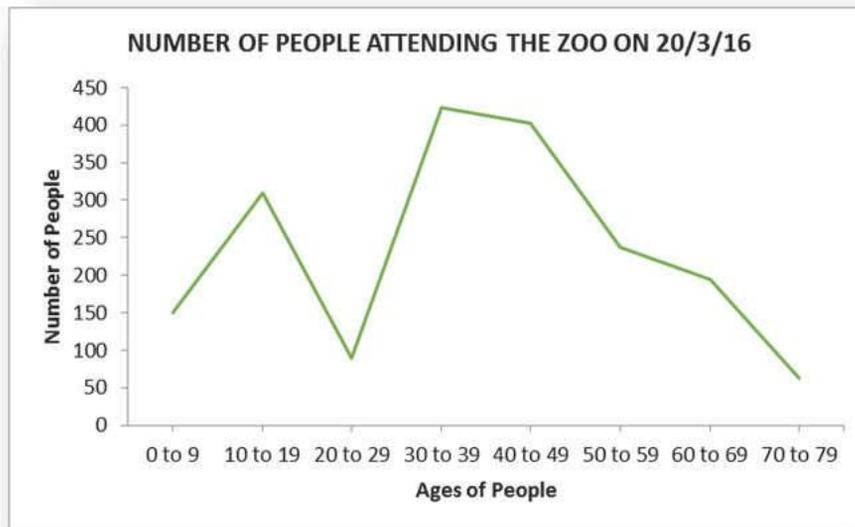
Why is a column graph the best choice for representing this data?

3. Ruby, Ronald and Ralph were asked to represent the same set of data on ages of people visiting the zoo on Sunday March 20th 2016. Below is a copy of the graphs they drew.

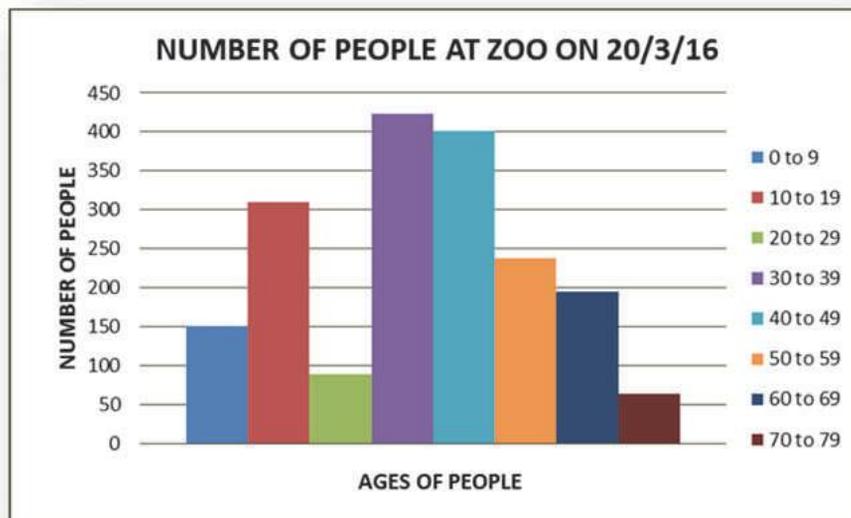
RUBY'S GRAPH – COLUMN GRAPH



RONALD'S GRAPH – LINE GRAPH



RALPH'S GRAPH - HISTOGRAM



- What is the same about each graph?
- Who chose the best graph to represent the data? Why?
- Explain why the other two graphs are NOT suitable for representing the data.
- What is the difference between a column graph and a histogram?
- When should a column graph be used instead of a histogram?

Whole Class Activity 3

Think: How do we analyse secondary numerical data?

A. We can analyse graphs and tables using numbers to summarise what is happening within the data.

The following stem and leaf plot represents the heights of the 2015 Australian World Cup Netball Team.

HEIGHTS OF THE 2015 WORLD CUP AUSTRALIAN NETBALL TEAM

17	3, 5, 6, 8, 8, 8
18	4, 5, 6, 8, 8
19	2

What do the numbers in the left hand column mean?



What do the numbers in the right hand column mean?



Read and analyse the stem and leaf plot to answer the following questions:

How many players were in the squad?



What was the median height of the players? How does the stem and leaf plot help in this calculation?



What was the modal height of the players?



What was the mean height of the players?



The range of data is the highest score subtract the lowest score. Find the range of heights of the girls.



What fraction of the players were 188 cm tall?



What percentage of players have heights in the 180 range?



Write 4 other number facts about this data not mentioned above:

-
-
-
-

Compare these facts with other class members. Add any facts you have missed to your list. What does the data suggest about the heights of elite netballers?

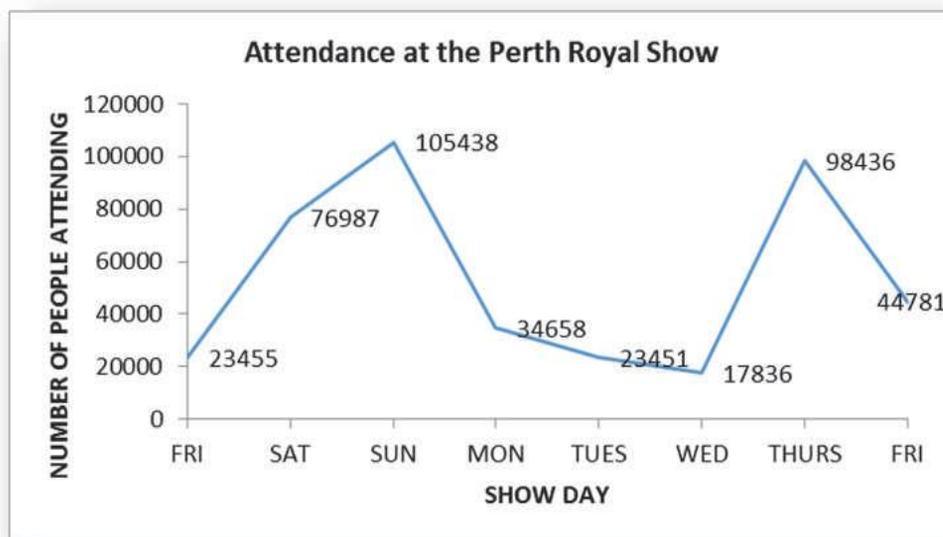


B. Look at the class **poster** created in **Whole Class Activity 1**. Write two number facts which describe each of the graphs.

Share your facts with other class members and write the four number facts that best describe the graphs, on the poster.

Practice Exercise 3

1. The following graph shows attendance at the Perth Royal Show over the 8 day period of the Show in 2013.

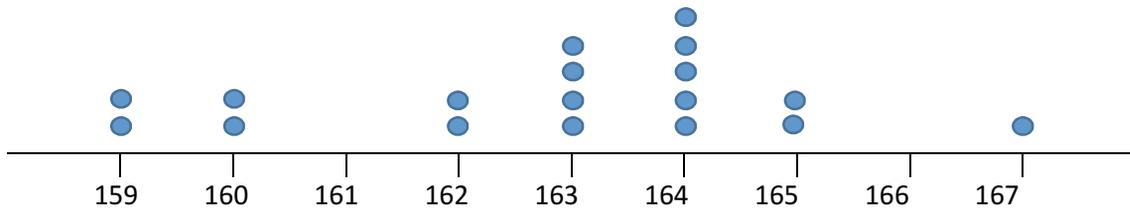


- a) How many people attended the Perth Royal Show overall?
- b) On what day did the least number of people attend?
- c) What fraction of the total attendance attended on Sunday?
- d) What was the mean attendance over the 8 days?
- e) What was the range in attendance?

f) Write 4 other number facts which describe this data:

-
-
-
-

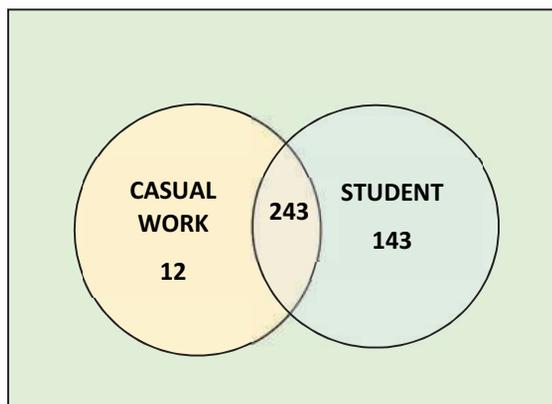
2. The following dot plot shows the heights of students (in centimetres) in a mathematics class at Esperance SHS.



- a) How many students were in the class?
- b) What was the modal height of the students? How can you tell this from the graph?
- c) What was the median height of the students? How can you tell this from the graph?
- d) What was the mean height of the students? How did you calculate this?
- e) What is the range in heights?
- f) Write 4 other number facts which describe this data.

-
-
-
-

3. The Department of Youth Affairs interviewed 400, 18 year olds on a University Campus about their work status and represented the results in the following Venn diagram.

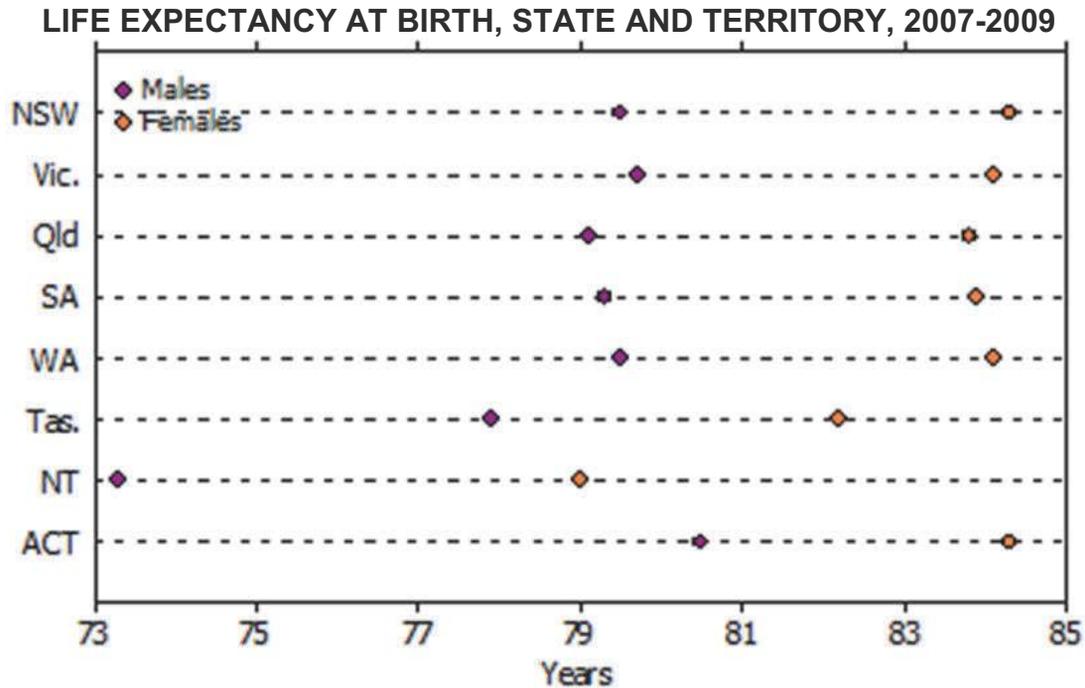


- a) What fraction of the 18 year olds were students who did casual work?
- b) What percentage of the 18 year olds were students who did no casual work?
- c) What fraction of the 18 year olds were students?
- d) How many 18 year olds did casual work but did not study?
- e) What was the modal category of 18 year olds on the University Campus?
- f) How many 18 year olds were on campus but were not students and did no casual work?

Whole Class Activity 4

Think: How do we interpret secondary data from graphs and tables?

A. The following data shows the life expectancy at birth for Australians in different states in 2007-2009.



Source: ABS [Deaths, Australia, 2009](#) (cat. no. 3302.0)

Interpreting this data involves:

1. Reading the data. Reviewing the times and locations in which the data was collected (e.g. In 2009, females lived longer than males).
2. Reading *between* the data. Making comparisons between data. (e.g. The difference between the life expectancy of a male and female in the NT is just under 6 years).
3. Reading *beyond* the data. Making inferences, predicting or looking for trends. (e.g. The lower life expectancy in the NT may be because of the higher indigenous population. Indigenous Australians are more likely to suffer life threatening diseases such as diabetes and heart disease).

Write statements concerning the graph above to show interpretation through:

Reading the Data.



Reading Between the Data.



Reading Beyond the Data.



B. The following table shows the cola preferences of 2 000 people, as a percentage, in Florida USA.

Age	10 -19	20-29	30-39	40-49	50-59	60-69	70-79
Coca Cola	64%	40%	54%	27%	35%	25%	25%
Coke Zero	2%	10%	13%	15%	18%	22%	43%
Diet Coke	10%	24%	20%	23%	29%	17%	15%
Pepsi Max	6%	18%	6%	10%	13%	24%	14%
Pepsi Light	0%	3%	0%	3%	2%	6%	0%
Pepsi	18%	5%	7%	22%	3%	6%	3%
Total	100%	100%	100%	100%	100%	100%	100%

Write statements concerning the table above to show interpretation through:

Reading the Data



Reading Between the Data



Reading Beyond the Data



If you worked for the advertising agency that produced television commercials for Coke Zero, how could you use the data to design an advertising campaign to boost sales?



C. Look at the class **poster** created in **Whole Class Activity 1**. Write two interpretations of the data in each of the graphs.

Share your interpretations with other class members and write the four interpretations that best describe the graphs, on the poster.

Practice Exercise 4

1. List 3 points that show interpretations of each of the graphs in Practice Exercise 3.

EXAMPLE	INTERPRETATION
a) Line Graph on Attendance at the Perth Royal Show in 2013	
b) The dot plot on the heights of students in a Mathematics Class at Esperance SHS	
c) The Venn diagram on the work status of 400 students on a University Campus	

2. The following stem and leaf plot represents the ages of people at the McDonald family picnic on Boxing Day.

BOYS		GIRLS
9,7,3,2	0	1,2,7,9
6,3	1	5,7,8
	2	
9,8	3	6,7
4,3,0	4	0,2,3
5,4,3	5	0,1,2
	6	
8	7	
1,0	8	3

Note: 5|0 means 50

- Suggest reasons for there being a lot of children between 0 and 9 at the picnic.
- Suggest reasons for there being no family members in their 20's or 60's at the picnic.
- What would you expect the data to look like in ten years' time?
- Which type of graph would best represent this data?

3. View the table from the Australian Institute of Criminology on the Number of Victims of Violent Crimes in Australia between 1996 and 2007 on the following website:

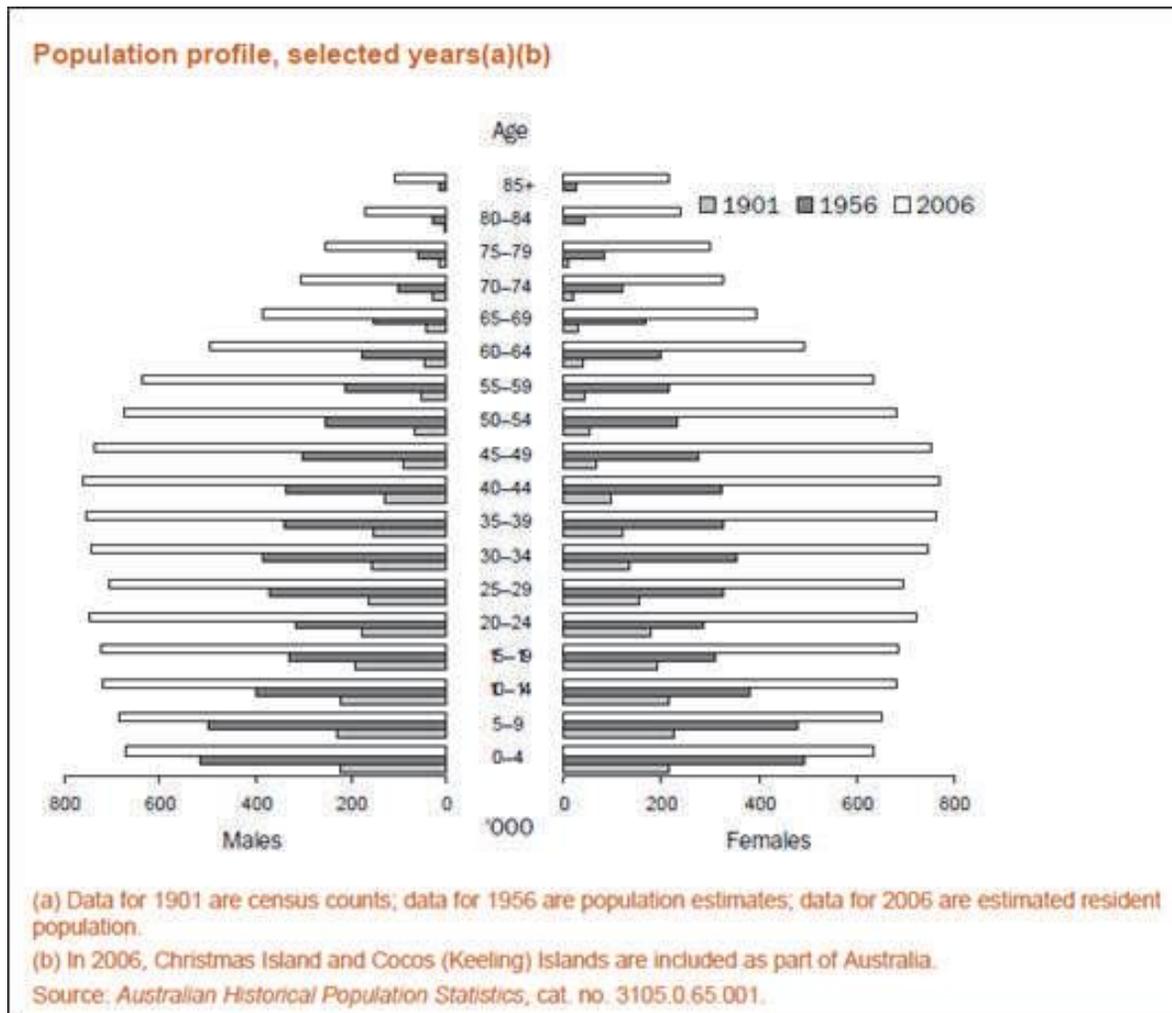
<http://www.aic.gov.au/statistics/violent%20crime/victims.html>

Read the interpretations of the data underneath the table.

a) Identify which interpretations are based on *Reading the Data*, *Reading Between the Data* or *Reading Beyond the Data*?

b) Write 3 more interpretations you can make from this table ensuring your interpretations cover reading the data, between the data and beyond the data.

4. The following graph shows the Australian Population by sex and age in 1901, 1956 and 2006.



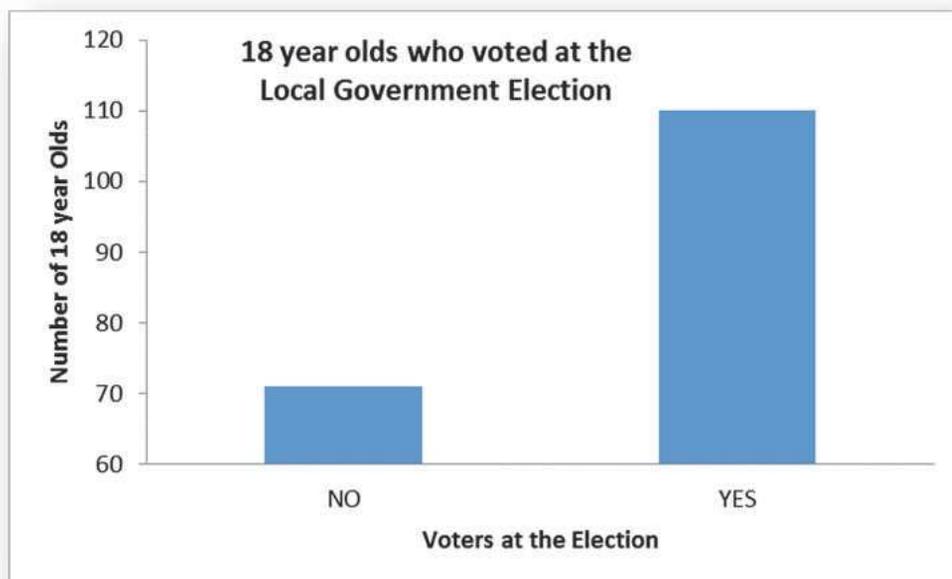
Source: A Picture of the Nation: the Statistician's Report on the 2006 Census, 2006.
 (ABS cat. no. 2070.0)

- a) Why were there no 85+ year olds in 1901?
- b) Describe the female population in the 0-4 age group for 1901, 1956 and 2006.
- c) In 1956 there were fewer 20-24 year olds than 15-19 and 25-29 year olds. When were these people born? Why are there less people in this category than the categories above and below?
- d) If you were to include this year's population statistics in this graph, how would you imagine they would differ from the statistics above?

Whole Class Activity 5

Think: How can graphs, tables and statistics be used to mislead people?

- A. Lauren looked at the graph below on the number of 18 year olds in Australind who had voted at a Local Government Shire Election. She commented 'The graph shows there are about 4 times as many 18 year olds, who voted, than those who didn't'.



Is this true? Explain your thinking.



- B. Use a search engine such as Google to view 'Images of Misleading Graphs'. Work with a partner to select 4 misleading graphs. Print the graphs, staple to the edge of this page and write why they are misleading.

Make a class list of ways in which graphs can be drawn, so as to be misleading.

C. The following statement was quoted in a local newspaper, The Merrington Gazette.

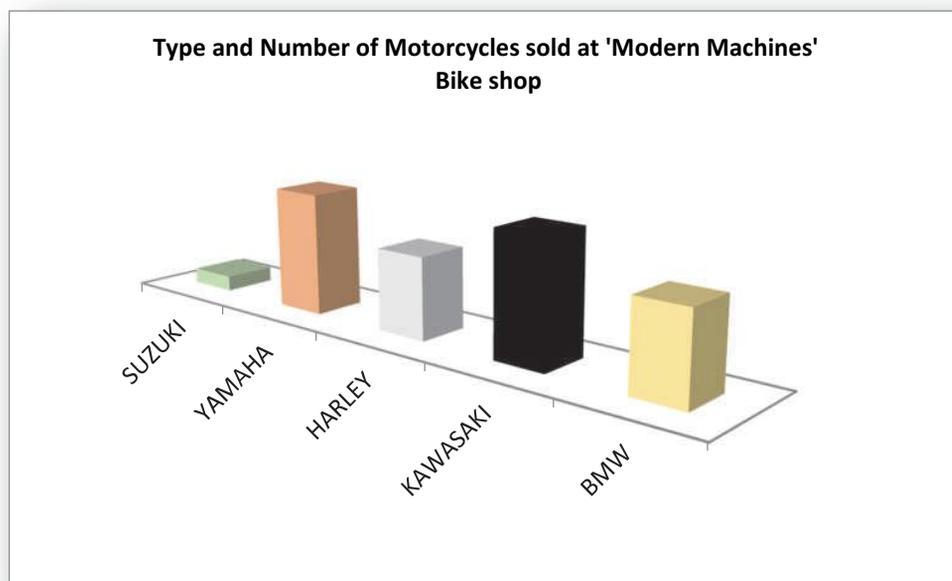
'A survey taken this week of Merrington cinema attendees, found that the average age of people going to the movies is now 58 years old!'

Ruby, a reader of the Gazette, felt that the quote was misleading. What questions could be asked of the Gazette to prove that the quote is misleading?



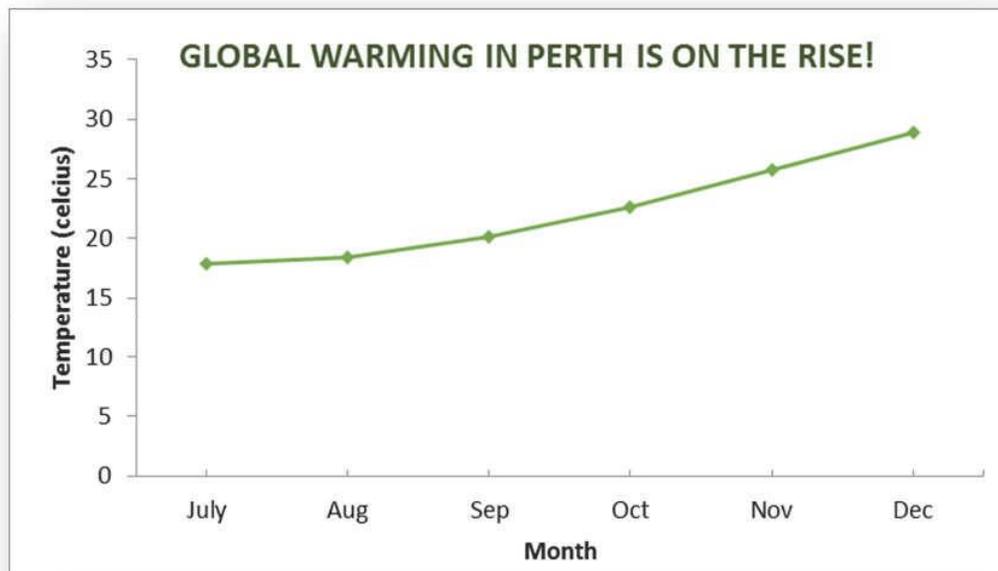
Practice Exercise 5

1. The following graph shows the type and number of motorcycles sold by 'Modern Machines' Bike shop in East Perth. The salesperson claims that more Kawasaki's are sold than any other motorbike.



- a) What is misleading about this graph?
- b) How does the salesperson use this graph to support his claim that more Kawasakis are sold than any other bike?
- c) How does the graph need to be altered to convey the correct information?

2. The following graph with this slogan was printed in a scientific journal.



Why is this graph misleading?

3. A University graduate is told the average salary at a company is \$42 000 pa. She asked to see the data which would support this statement. She was given the following 5 salaries:

Person A: \$28 000 Person B: \$27 000 Person C: \$30 000
Person D: \$98 000 Person E: \$27 000

- Calculate the mean, mode, median and range of this data.
- The graduate then found out that Person D was the General Manager of the business. Re-calculate the mean, mode, median and range of this data without the General Manager's salary.
- Comment on the average salary at the company being \$42 000. Is it true?

4. Comment on why the statistics in the following statements could be misleading.

- A toy company produces 400 robots per day. A worker examines the first 10 and finds that 6 are defective. He concludes that 60% of the toys produced that day are defective.
- A local newspaper wanted to write a story about sports people enjoy. They interviewed the first 25 people to leave a football ground.
- The following statement was made on a current affairs television programme:
'70% of Australian children aged 8 – 13 years old are obese'

Reflection on Learning

The following sex and ages of 30 people was found in a journal with the title of the data torn off:

M 13, F 68, F 32, M16, M 23, F 78, F 54, M 45, F 42, M 12, F 80, F 56, M 34,
M 23, F 45, F 78, M 21, M 34, F 56, F 34, M 45, M 29, F 43, F 41, M 37, F 28,
F 90, M 38, M 30, F 68.

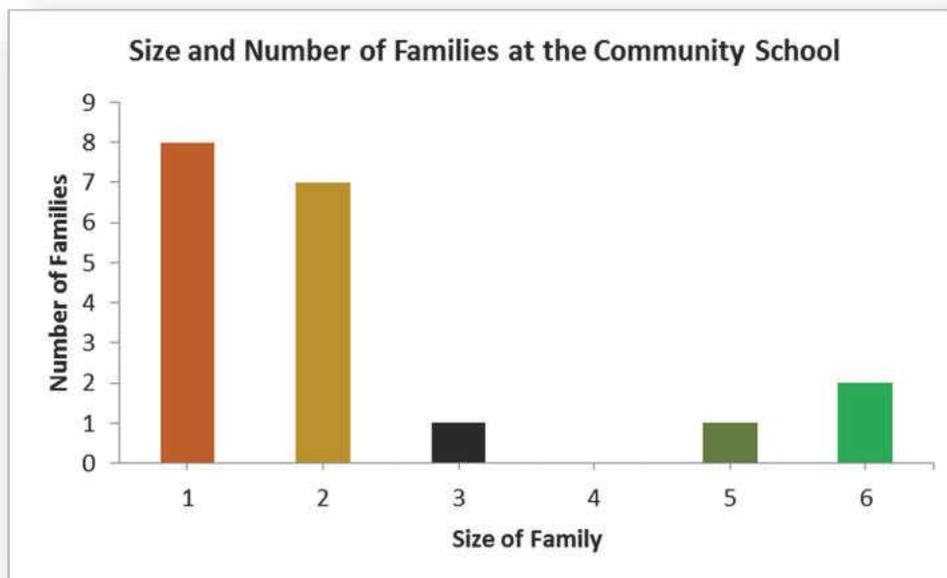
Create a scenario that the collected data is based on.

Prepare a written report based on the data. Your report should include:

- A paragraph explaining the purpose of collecting the data.
- The question(s) asked to collect the data. When, where how and from whom the data was collected. Whether the data collected is a sample or a population.
- A table and a suitable computer generated graph to represent the data.
- An analysis of the data using number facts.
- An interpretation of the data looking at the data, between the data and beyond the data.

OLNA Practice Questions

- (viii) The following graph shows the number and size of families belonging to a small community school east of Roebourne.



The mean number of children per family is:

- A. 2.2 B. 2 C. 1 D. 4

2. The following stem and leaf plot shows the heights of boys and girls in a junior soccer squad.

GIRLS		BOYS
7, 6, 0	15	
8, 5, 3	16	5, 7
3, 1	17	2, 4, 5, 9
	18	2, 3, 8, 8
	19	1, 5

Which statement is NOT true about the data?

- A. The modal height is 188 cm.
- B. The boys are generally taller than the girls.
- C. The range in heights is 45 cm.
- D. The median girls height is 165 cm.



Section Three

Application of the Mathematical Thinking Process

Content Focus

Foundation Mathematics

- 4.3.1 Integrate functional numeracy concepts to solve problems related to personal, work and community contexts
- 4.3.2 Read write and compare whole numbers
- 4.3.3 Understand and use the relationships between the four operations to assist in calculations
- 4.3.4 Choose the operation to efficiently solve a problem mentally, with a calculator or spreadsheet
- 4.3.5 Tell the time and work out elapsed time using different units
- 4.3.6 Calculate how to be on time
- 4.3.7 Read and use various forms of timetables
- 4.3.8 Estimate, measure and calculate length, mass and capacity.
- 4.3.9 Use relationships between metric units to estimate, measure and calculate length, mass, capacity, perimeter, area and volume
- 4.3.10 Read and interpret various tables, charts and graphs
- 4.3.11 Read, interpret and draw various maps and plans
- 4.3.12 Construct simple 3D objects from plans.

Australian Curriculum Link

- ACMNA058 Model and represent unit fractions including $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{5}$ and their multiples to a complete whole
- ACMMG061 Measure, order and compare objects using familiar metric units of length, mass and capacity
- ACMMG062 Tell time to the minute and investigate the relationship between units of time
- ACMNA077 Investigate equivalent fractions used in contexts
- ACMNA078 Count by quarters halves and thirds, including with mixed numerals. Locate and represent these fractions on a number line
- ACMNA079 Recognise that the place value system can be extended to tenths and hundredths. Make connections between fractions and decimal notation
- ACMMG084 Use scaled instruments to measure and compare lengths, masses, capacities and temperatures
- ACMMG085 Convert between units of time
- ACMMG086 Use am and pm notation and solve simple time problems
- ACMMG090 Use simple scales, legends and directions to interpret information contained in basic maps
- ACMNA099 Use estimation and rounding to check reasonableness of answers to calculations
- ACMNA102 Compare and order common unit fractions and locate and represent them on a number line
- ACMNA104 Recognise that the place value system can be extended beyond hundredths
- ACMNA105 Compare, order and represent decimals
- ACMMG108 Choose appropriate units of measurement for length, area, volume, capacity and mass
- ACMMG109 Calculate perimeter and area of rectangles using familiar metric units
- ACMNA123 Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers
- ACMNA125 Compare fractions with related denominators and locate and represent them on a number line
- ACMNA131 Make connections between equivalent fractions, decimals and percentages
- ACMMG135 Connect decimal representations to the metric system
- ACMMG136 Convert between common metric units of length, mass and capacity
- ACMMG137 Solve problems involving the comparison of lengths and areas using appropriate units
- ACMMG138 Connect volume and capacity and their units of measurement
- ACMMG139 Interpret and use timetables
- ACMNA157 Connect fractions, decimals and percentages and carry out simple conversions
- ACMMG159 Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving
- ACMMG160 Calculate volumes of rectangular prisms
- ACMMG199 Solve problems involving duration, including using 12- and 24-hour time within a single time zone
- ACMMG159 Establish the formulas for areas of rectangles, triangles and parallelograms, and use these in problem-solving
- ACMMG160 Calculate volumes of rectangular prisms
- ACMMG195 Choose appropriate units of measurement for area and volume and convert from one unit to another
- ACMMG198 Develop formulas for volumes of rectangular and triangular prisms and prisms in general. Use formulas to solve problems involving volume
- ACMMG216 Calculate areas of composite shapes
- ACMMG290 Compare objects using familiar metric units of area and volume

Topic 1

Numeration and Operations: Whole Numbers and Money

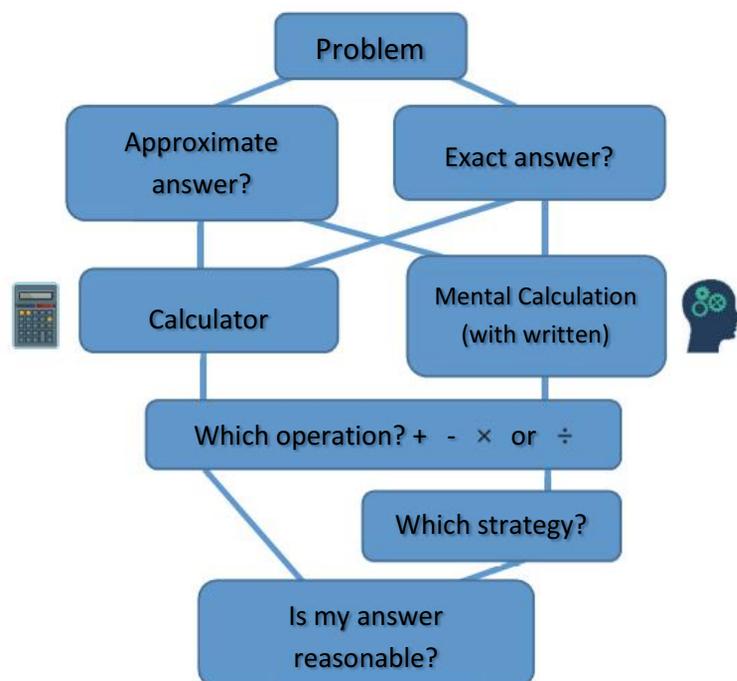
Mathematics Discussion

When solving everyday problems involving mathematics in personal, workplace and community situations, we work through a decision making process outlined in the flow diagram.

The first step in this process is - interpreting the **PROBLEM**. This involves, identifying the key information. We then extract the mathematics from this information. This usually involves locating the numbers in the problem and deciding what mathematics to use with these numbers in order to solve the problem. In this section, we will be focussing on the **UNDERSTANDING THE PROBLEM** section of the decision making flow chart.

Our next decisions are generally whether an **APPROXIMATE ANSWER** or **EXACT ANSWER** is needed and whether the problem is best solved using a **CALCULATOR/SPREADSHEET** or **MENTALLY**. Sometimes we can use a combination of these choices.

We then need to decide **WHICH OPERATION**, $+$, $-$, \times or \div to use. This decision is helped by writing number sentences to reflect the problem, using diagrams like part/part whole, arrays and rate tables. It may involve the choice of a complex range of operations. If using a mental calculation, we then decide on a **STRATEGY** such as doubling and doubling again for $\times 4$. Jottings can be used to show and support our thinking.



After finding a SOLUTION, finally, we must ask ourselves, IS MY ANSWER REASONABLE? We should reflect on the results to judge reasonableness in relation to the problem we are trying to solve. Sometimes, reflection on the solution leads to a whole set of new problems to solve.

In this section we will be focussing on everyday problems concerning choosing and using the four operations with whole numbers.

Whole Class Activity 1

SCENARIO: Sann is an 18 year old student from Bunbury, who has recently applied for and won his first casual job selling reticulation at 'Total Water'. His first payslip shows he earns \$434 per week.

Sann wants to move out of the family home into a share house rental accommodation with 3 friends. His research on real estate websites in the Bunbury area shows that the median rental price for a 4 bedroom house is \$460 per week.

To move out, Sann will need to consider how much money he needs for *upfront payments* and to cover his *initial living costs* for the first month. His upfront payments will include: bond (four weeks rent), two weeks rent in advance and furniture (Sann will need to purchase a bed and some furniture to contribute to the living and kitchen areas). After a discussion with his parents, he estimates his initial living costs will be: \$175/week for food, \$40/month for electricity, \$12/month for water, \$10/month for contents insurance and \$18/fortnight for a mobile phone plan.



He is budgeting to save \$300 per month from his job toward moving out. How long will it take Sann to save to enough money to move into a rental?

(i) The scenario above involves solving two problems. Circle each problem in the information and rewrite them in your own words in the space below:

PROBLEM 1 There are two parts:.

PART A:

PARTB:

PROBLEM 2

(ii) Highlight the key information for PROBLEM 1 in yellow (PART A) and green (PART B).

Highlight the key information for PROBLEM 2 in blue.

(iii) What operations (+, -, × or ÷) are used in each of the problems?	
PROBLEM 1 PART A: PART B:	PROBLEM 2
(iv) Which problem will you need do work on first? Why?	
(v) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to solve these problems? Does it require both when solving?	
(vi) Is it most efficient to use MENTAL strategies, a CALCULATOR or a SPREADSHEET to solve? Justify your answer.	
(vii) Write a number sentence and solve each of the problems. Use written jottings, diagrams, such as part/part whole and arrays, if necessary.	
PROBLEM 1 PART A: PART B:	PROBLEM 2
(viii) Write the SOLUTION below.	
PROBLEM 1	PROBLEM 2
(ix) ARE MY ANSWERS REASONABLE? Use rounding and estimation to verify your results. Check your solutions make sense in terms of the context. Write your results using the language in the problem.	
PROBLEM 1	PROBLEM 2

Reflect on the problem. What could Sann do to make the financial move to independent living easier or quicker?

Reflection and Discussion

In your group, find out what mental calculation strategies, if any, were used by those who chose to use mental. Record the strategies below.



In order to get better at mental calculations, it helps to continue to practise. This Whole Class Activity could have been completely solved using mental calculation strategies with the four operations. Review these skills now.

Use mental calculation strategies and jottings to show your thinking to solve:

$165 + 50$



4×135



$3\,000 - 2\,160$



$2\,700 \div 300$



Skills Practice 1

1. Use mental strategies and jottings to solve these addition and subtraction problems:

a) $27 + 31$

d) $\$92 + \77

b) $\$40 + \98

e) $600 + 32 + 150$

c) $85 - 42$

f) $300 - 180 - 25$

2. Use mental strategies and jottings to solve these multiplication and division problems:

a) $4 \times \$185$

d) $5 \times \$115$

b) $\$540 \div 4$

e) 410×300

c) 26×2

f) $2\,400 \div 600$

Small Group Activity

SCENARIO: At the start of his casual job, Sann is asked to pack 35 000 small trickle sprinkler heads into bags of 100, 50, 10 and to have some left over for individual sale.

The following table shows the sale of these bags of sprinkler heads each week for a 4 week period.

Bag Sizes	Week 1	Week 2	Week 3	Week 4
Bags of 100	32	30	81	150
Bags of 50	10	8	16	26
Bags of 10	14	15	25	200
Individual Sprinklers	3	5	11	14

Decide how many sprinkler heads ‘Total Water’ should order for the next 4 week period. Consider how many of the 35 000 sprinkler heads were sold in this 4 week period and the trend in the total weekly sales. How many bags of 100, 50 and 10 sprinkler heads should Sann make up at the start of the next month?

(i) The scenario above involves solving two problems. Circle each problem in the information and rewrite them in your own words in the space below:	
PROBLEM 1	PROBLEM 2
(ii) Which problem will you need to work on first? Why?	
(iii) Highlight the key information for the first problem in yellow. Highlight the key information for the second problem in blue.	
(iv) What operations (+, -, × or ÷) are used in each of the problems?	
PROBLEM 1	PROBLEM 2

(v) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to solve these problems? Does it require both when solving?

(vi) Is it most efficient to use MENTAL strategies, a CALCULATOR or a SPREADSHEET to solve? Justify your answer.

(vii) Write number sentences and solve Sann's problems. What STRATEGY will you be using to solve each of the problems? Use diagrams, such as part/part whole and arrays to show your thinking, if necessary.

PROBLEM 1

PROBLEM 2

(viii) Write the SOLUTION below.

PROBLEM 1

PROBLEM 2

(ix) ARE MY ANSWERS REASONABLE? Use rounding and estimation to verify your results. Check your solutions make sense in terms of the context.

Write your results using the language in the problem.

PROBLEM 1

PROBLEM 2

(x) Reflect on the problems and explain your choice of the number of sprinkler heads that should be ordered and the size of the packs for the start of the next 4 week period.

Reflection and Discussion

The scenario in this Small Group Activity requires a number of skills. Reviewing these skills will help in the solution of Sann's problems.

Discuss and use jottings to show your thinking when solving:

$70 + 95$



410×100



$45\,000 - 31\,000$



42×50



10×175



$60\,000 \div 100$

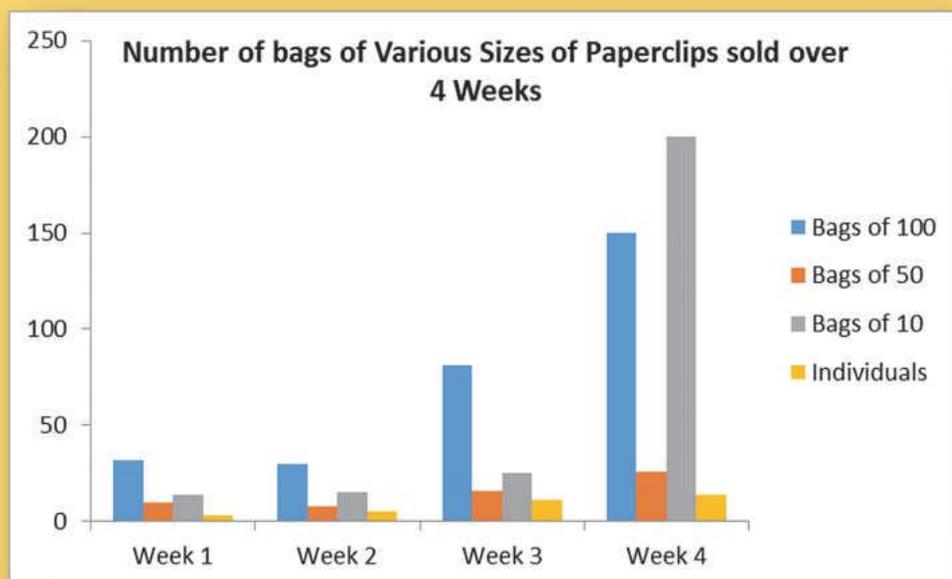


Place the following numbers in ascending order:

1 191, 1 190, 1 910, 9 199, 1 901, 1 119.



Use the graph of the sales of paperclips over the 4 week period to comment on the trend in sales. Is it easier to use a table or a graph to analyse the data? Explain your thinking.



Skills Practice 2

1. Use mental strategies to solve these addition and subtraction problems:

a) $57 + 13$

d) $34 + 36 + 17$

b) $\$48 + \240

e) $125\,000 - 95\,000$

c) $9 + 13 + 25 + 8$

f) $55\,000 - 42\,500$

2. Use mental strategies to solve these multiplication problems:

a) $10 \times \$215$

d) $5 \times \$14$

b) 18×100

e) 180×50

c) 10×310

f) $50 \times \$48$

3. Use mental strategies to solve these division problems:

a) $60 \div 10$

d) $6\,300 \div 100$

b) $500 \div 50$

e) $910\,000 \div 10$

c) $740 \div 10$

f) $55\,000 \div 100$

4. Write the following numbers in descending order:

a) 58, 60, 59, 57, 61, 56.

b) 341, 314, 143, 413, 431, 134.

c) 2 345, 2 435, 2 543, 2 453, 2 354, 2 534.

d) 11 200, 1 120, 11 002, 1 201, 12 110, 2 101.

e) 45 608, 45 806, 54 680, 64 580, 45 068, 45 008.

f) 879 004, 878 904, 879 094, 878 409, 879 409, 897 004.

5. The following table shows the number of packets of paper clips sold at a newsagent over a weekly period. Open a new spreadsheet and set up a table.

	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
Packs of 200	37	23	41	87	12	9	8
Packs of 100	62	48	57	41	23	15	14
Packs of 50	126	115	98	87	32	18	32
Packs of 10	3	5	7	2	1	2	2

- What was the most popular type of pack sold? How do you know?
- What formula would you use to determine the total number of paperclips sold on a Monday?
- What formula would you use to determine the total number of paperclips sold in Packs of 50 on a Wednesday?
- What formula would you use to determine the total number of paperclips sold in Packs of 200 over the week?
- What graph would you choose to display the number of different packs sold on a Thursday?
- What graph would you use to display the number of Packs of 200 sold in each day over the week?

Individual Activity 1

SCENARIO: Sann is asked to complete a 4 day training course for work. He will be staying with a friend in Bassendean and the course is held in Perth City. Sann decides to catch the bus to and from the course each day. Sann wants to know the cheapest way to catch the bus. He finds that one way fares are \$4.50 per ticket. The alternative is to buy a Smartrider card for \$10 and put some money on the card. With a Smartrider, one way fares are \$3.80 per ticket on the card. What is Sann's cheapest option?

(i) Circle the problem in this scenario and rewrite it in your own words in the space below:	
(ii) Write the two alternatives presented in the problem:	
ALTERNATIVE 1	ALTERNATIVE 2
(iii) Highlight the key information for the first alternative in yellow. Highlight the key information for the second alternative in blue.	
(iv) What operations (+, -, × or ÷) are used in each of the alternatives?	
ALTERNATIVE 1	ALTERNATIVE 2
(v) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to solve these problems? Does it require both when solving?	
(vi) Is it most efficient to use MENTAL strategies, a CALCULATOR or a SPREADSHEET to solve? Justify your answer.	
(vii) Write number sentences to solve the two alternatives in Sann's problem. What STRATEGY will you be using to work through each of the alternatives? Use diagrams, such as part/part whole and arrays to show your thinking, if necessary.	
ALTERNATIVE 1	ALTERNATIVE 2
(viii) What is the overall SOLUTION to the problem?	
(ix) IS MY ANSWER REASONABLE? Use rounding and estimation to verify your results. Check your solution makes sense in terms of the context. Write your results using the language in the problem.	

Reflection and Discussion

The scenario in this Individual Activity uses *order of operations* to solve. Reviewing this skill will help us solve Sann's problems.

Discuss and use jottings to show your thinking when solving:

$$\$20 + 3 \times \$2.50$$



$$45\,000 - 1\,200 + 24\,000$$



$$\$36 - 8 \times \$4.50$$



$$32 \times 10 + 41 \times 100$$



In what order do we solve operations?



Skills Practice 3

1. Solve the following problems using mental strategies and jottings:

a) $10 + 3 \times 16$

d) $80 - 5 \times 14$

b) $16 \times 100 + 30 \times 10$

e) $2\,000 - 400 + 350 + 100$

c) $5 + 70 \times 100$

f) $20 + 110 \div 10$

Individual Activity 2

Create your own problem solving table to solve this problem.

SCENARIO: Sann works the following hours in his casual retail job as a sales assistant for 'Total Water': 8 am – 5.00 pm on Fridays; 11.30 am - 5.30 pm on Saturdays and 10.30 am - 4 pm on Sundays; with penalty rates for Saturday and Sunday. Sann's first payslip stated his take home pay was \$434. His payslip shows that he gets paid \$11.86 per hour.

Sann thought his pay was correct but decided to check it.

Is Sann's pay correct? What could Sann do if his pay was incorrect?

(Note: Pay rates change over time. You might like to check what hourly rate he should be paid this year, at the 'Fairwork' website)

View: <https://calculate.fairwork.gov.au/CheckPay/Summary>

Reflection and Discussion

This **Scenario** focuses on choosing the correct operation and the best method (mental, calculator or spreadsheet) to solve the problem. Complete the following activities to review these skills.

If Sann worked a 6 hour shift on Tuesday at 'Total Water' and was paid \$19.72/hour, circle the calculation you would use to calculate his total wage for the day?

$6 + 19.72$

$19.72 - 6$

6×19.72

$19.72 \div 6$

Justify your answer.



Would you use a mental strategy, calculator or spreadsheet to find the answer? Justify your thinking. Find the total wage.



If Sann worked 6 hours and was paid \$19/hour, would you use a mental strategy, calculator or spreadsheet to find his total wage? Justify your thinking. Find the total wage.



Sann worked 6 hours on Tuesdays at \$18.70/h, 8 hours on Thursdays at \$19.10/h and 7 hours on Saturdays at \$21.23/h, every week for the year. He took 4 weeks off in the middle of the year for exams. How could Sann keep a record of his earnings to find his total yearly wage? Would you use a mental strategy, calculator or spreadsheet. Justify your thinking.



How do you decide when to use a mental strategy, calculator or spreadsheet to solve a problem?



Skills Practice 4

1. Choose the best strategy (mental, calculator or spreadsheet) and then solve the following problems

a) $7 \times \$35.76$

c) $8 \times 18.54 + 7 \times 19.11 + 5 \times 23.87$

b) $410 + 390$

d) $18\,900 \div 10$

Individual Activity 3

Create your own problem solving table to solve this problem.

SCENARIO: Whilst Sann was living with his family, he opened a savings bank account and put \$442 in it. He was hoping to have a balance of \$3 000 in the account after 6 months. How much will Sann need to save per month in order to achieve his goal? Given that Sann earns \$434 per week, is this an achievable goal?

Reflection and Discussion

This **Scenario** focuses on choosing the correct operation to solve problems. Complete the following problems to review these skills. Explain how to solve each problem.

$$? \times 20 = 4\,600$$

$$78 - ? = 56$$

$$120 + ? = 310$$

$$? \div 2 = 58$$



Skills Practice 5

1. Choose the correct operation and solve the following problems.

a) $5 \times ? = 125$

d) $2\,300 - ? = 120$

b) $320 + ? = 800$

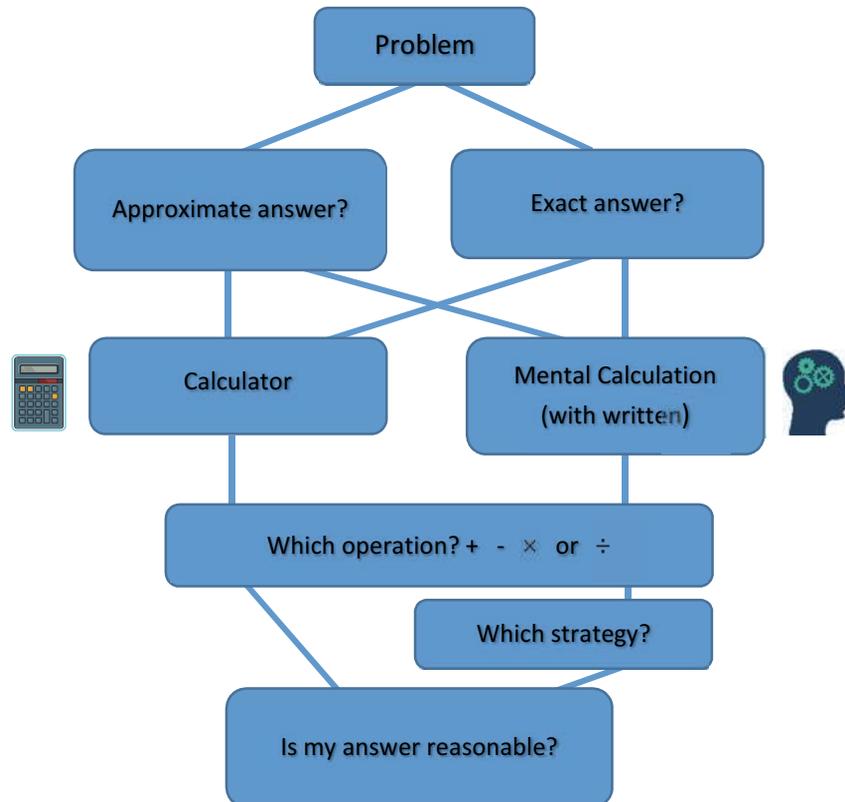
e) $? \div 100 = 72$

c) $? - \$67 = \129

f) $200 + ? \times 4 = 1\,000$

Reflection on Learning A

Consider the problem in Individual Activity 3. Reflect on how you solved the problem based on the decision making flow chart below.



Did you work through all the stages in the decision making flow chart to find the amount Sann would need to save each month? Did you work through all the stages of the chart when determining whether the amount he would need to save each month was achievable? Explain your thinking.



Were there any steps in the decision making flow chart that you completed in a different order to that outlined in the chart? If so, justify the order of problem solving you chose.



How could completing the final step in the chart 'Is my Answer Reasonable?' cause you to work through, some or all, of the steps in the chart again? Did this occur in Individual Activity 3 for you? Explain your thinking.



Reflection on Learning B

In which scenario was it best to use an estimation rather than an exact solution?



In which scenarios did you use a calculator to help solve all parts of the problem? What information in the problem told you that this was the correct method of finding a solution?



Were there any scenarios that you used only mental strategies to solve? If so, which scenarios and what mental strategies did you use?



Which scenario(s) used all four operations (+, - \times or \div) to solve?



When did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Why?



Self-Assessment

Complete the following self-assessment to focus your attention on your own learning needs.

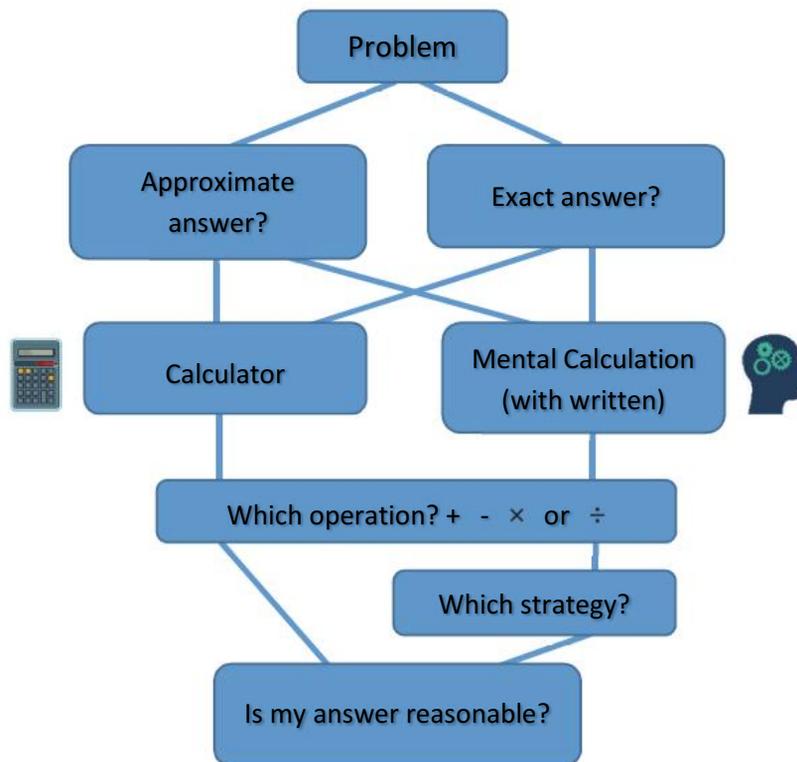
	What did you find easy?	What did you find hard?	What part do you still need to work on?
Mathematics Thinking Process			
Skills			

Topic 2

Numeration and Operations: Fractions, Decimals and Percentages

Mathematics Discussion

When solving everyday problems involving mathematics, we work through a decision making process outlined in the flow diagram below:



Sometimes we work through the thinking process in the order shown in the diagram above. Sometimes we need to jump a step and come back to it later.

Two of the most important steps in the process are:

1. Analysing the problem.
2. Reflecting on the answer to ensure that it is reasonable.

Analysing the problem carefully ensures that the correct problem is being answered. It also helps us to make a series of decisions; to decide whether an estimation or an exact answer is needed, whether to use a calculator or not, and which operation/s to use.

Reflecting on the answer to ensure that it is reasonable helps us to know whether we have the correct answer. Sometimes we realise that our answer is not correct and we need to go back and re-analyse the problem, and the mathematics we have completed to solve it. This may result in reworking the problem, including all of the steps in the thinking process, or jumping some steps and focussing on one or two of the steps. The thinking process should be used as a guide, but it can be altered when needed.

Whole Class Activity 1

Scenario: Melva is attending her school ball in 5 months and has found a dress she wants to buy. The dress costs \$349.00

Melva is deciding whether to put the dress on layby or use her mum's credit card to purchase it.

If Melva puts the dress on layby she must pay 20% deposit, plus a \$3 layby fee. The remaining amount is then split into 3 fortnightly repayments. How much will Melva have to pay each fortnight? What is the total cost of the dress?

If Melva pays for the dress with her mum's credit card she will take the dress home today but will have to pay off the debt plus any interest in the bank charges. Each month the outstanding balance earns 14% pa interest. Melva can afford to pay \$70 off the credit card straight away so this amount does not earn interest. She plans to pay \$150 every month. How long will it take Melva to pay the credit card debt? What is the total cost of the dress?

(i) The scenario above involves solving two problems. Circle each problem in the information and paraphrase them in the space below:

PROBLEM 1

PROBLEM 2

(ii) Highlight the key information for PROBLEM 1 in yellow.

Highlight the key information for PROBLEM 2 in blue.

(iii) What operations (+, -, \times or \div) are used in each of the problems?

PROBLEM 1

PROBLEM 2

(iv) Which problem will you need to work on first? Why?

(v) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to solve these problems? Does it require both when solving?

(vi) Using a table is an efficient way to model each problem. Is it most efficient to use MENTAL strategies, a CALCULATOR or a SPREADSHEET to complete each table? Justify your answer.

(vii) Use your chosen strategy to complete the tables below.

Option 1 Layby

Deposit	Layby fee	Payment	Payment	Payment	Total Cost

Option 2 Credit Card

Create your own table below.

(viii) What calculations did you need to do to solve each of the problems?

PROBLEM 1

PROBLEM 2

(ix) IS MY ANSWER REASONABLE? Use rounding and estimation to verify your results. Check your solution makes sense in terms of the context.

Write your results using the language in the problem.

PROBLEM 1

PROBLEM 2

(x) Reflect on the problem. Which option do you think Melva should take? Why?

Reflection and Discussion

How did 'analysing the problem' scenario help you to decide how to solve the problem?



Did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Which sections and why? Share your thinking with others.



The ball dress scenario can be solved using a mixture of mental, calculator and spreadsheet calculations.

Which parts of the problem were best solved mentally?



Which parts of the problem were best solved with a calculator?



Which parts of the problem could be solved using a spreadsheet?



Some percentages can be calculated mentally, while others may be more easily solved using a calculator. Circle the percentage calculations below that you would solve mentally and then solve them.

a) Tahlia decides to spend 75% of her \$300 pay on tickets to a concert. How much money will she have left?

b) Julie gets paid \$17.80 per hour, and gets a 33% loading on public holidays. What is Julie's hourly rate on public holidays?

c) 150 people were surveyed about whether they thought the log book requirements for getting a driver's license were too much, just right or not enough. 43% of the people said they thought the requirements were just right. How many people is this?

d) Last month Mike sold \$682 worth of product on his website. He needs to save 20% of this amount to pay his bills and buy more stock. How much does he need to save?

e) Mihal is planning to buy a new phone. The one he wants costs \$285. It is on sale for 15% off. How much will he pay for the phone?

For the calculations you did not circle, use your calculator to solve them, jotting down what you did.

Skills Practice 1

1. Use mental strategies to calculate these percentages.

- | | |
|-----------------|-------------------|
| a) 20% of \$110 | d) 5% of 2 000 |
| b) 10% of \$320 | e) 45% of 1 200 |
| c) 30% of \$45 | f) 115% of 23 000 |

2. Use mental strategies and jottings to calculate these percentages.

- | | |
|-----------------|--------------------|
| a) 12% of \$250 | d) 15% of \$4 000 |
| b) 25% of \$82 | e) 75% of 120 400 |
| c) 20% of \$153 | f) 110% of 200 000 |

3. Work out the discounted price in each situation, using mental or written methods.

- | | |
|-------------------|--------------------|
| a) 40% off \$29 | d) 32% off \$989 |
| b) 5% off \$1 250 | e) 17% off \$3 520 |
| c) 25% off \$790 | f) 74% off \$17 |

4. Use a calculator to solve each of the following percentage problems.

HINT: to find 10% of 20, either multiply 0.1×20 or $20 \times 10\%$.

- | | |
|--------------------|------------------|
| a) 16% of \$5 730 | d) 33% of 980 |
| b) 20% of \$82 050 | e) 72% of 2 580 |
| c) 5% of \$753 000 | f) 110% of 3 450 |

5. Calculator Game: First to 100

A partner game using one calculator.

Aim: to be the first to get to 100 using only multiplication.

Rules of the Game

Person one puts a number into the calculator, eg, 17.

Person two multiplies this number by a chosen number in order to get 100.

If the number on the screen shows 100 (plus some decimals numbers) then they are the winner.

If the number on the screen is not showing 100 the calculator is passed to person one who multiplies the number on the screen by a chosen number.

The calculator is passed back and forth between the two players until one person is able to get 100 (plus some decimal numbers) on the screen.

HINT: you may need to use decimals.

Small Group Activity

Scenario: James drives a car with a 55 litre fuel tank. Label the half, quarter and three quarter marks on the fuel gauge below.

Choose three more marks on the gauge to label using a fraction.



James wants to know how many litres of fuel he has in the tank when he looks at the marks on the fuel gauge and how many litres of fuel would be needed to fill the tank for each mark.

(i) The scenario above involves solving two sets of problems. Circle each in the information and rewrite them in your own words in the spaces below:	
PROBLEM SET 1	PROBLEM SET 2
(ii) What operations (+, -, \times or \div) are used in each of the problems?	
PROBLEM SET 1	PROBLEM SET 2

(iii) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to solve these problems? Does it require both when solving?

(iv) Is it most efficient to use MENTAL strategies, a CALCULATOR or a SPREADSHEET to solve? Justify your answer.

(v) Write the number sentences you will use to work out each set of problems and solve. What STRATEGY will you be using to solve each of the problems? Use diagrams, such as part/part whole and arrays to show your thinking, if necessary.

PROBLEM SET 1

PROBLEM SET 2

(vi) Write the SOLUTIONS in the table below.

Fuel Gauge Mark	Litres in the tank	How many litres needed to fill tank
$\frac{1}{4}$		
$\frac{1}{2}$		
$\frac{3}{4}$		

(vii) ARE MY ANSWERS REASONABLE? Use rounding and estimation to verify your results. Check your solutions make sense in terms of the context and that the answers are written using the language in the problem.

PROBLEM SET 1

PROBLEM SET 2

Reflection and Discussion

How did 'analysing the problem' scenario help you to decide how to solve the problem?



Did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Which sections and why? Share your thinking with others.



Why would it be useful to know what the fuel gauge markings mean in litres?



If James wanted to calculate the cost of filling his tank, how might he use the information above to do this?



If fuel cost 104.4 cents per litre, and James already had $\frac{1}{4}$ of a tank of fuel. How much would it cost to fill up the tank? Discuss the operations you might use to calculate this and jot down how to work it out.



Skills Practice 2

1. Use mental strategies and jottings to work out these fraction amounts.

a) $\frac{1}{4}$ of 90

d) $\frac{6}{10}$ of 1530

b) $\frac{1}{8}$ of 456

e) $\frac{3}{8}$ of 652

c) $\frac{2}{5}$ of 560

f) $\frac{3}{4}$ of 2420

2. Read each problem below, write the operation needed to solve it, then solve.

a) James used $\frac{1}{4}$ of a tank of petrol to get to his friend's house. He kept driving and when he arrived at his final destination the petrol gauge was on the $\frac{6}{8}$ mark. What fraction of the tank did James use between his friend's house and his final destination?

b) Jill is renting a car on her holiday to New Zealand. She needs to pay $\frac{2}{10}$ of the total cost when she picks up the car from the airport on arrival. The total cost of renting the car is \$490. How much must she pay at the airport?

c) Jemma has a market stall selling candles. This weekend she has 145 candles to sell. On Saturday she sold $\frac{1}{5}$ of her stock and on Sunday she sold another $\frac{3}{5}$ of the original stock. How many candles did Jemma sell over the weekend?

d) Jai made a cake for a family birthday, $\frac{3}{16}$ was eaten straight away and then the guests took another $\frac{4}{8}$ home with them. What fraction of the cake was left?

e) Jaheel earned \$4 250 during January quarter. During the April quarter she increased her earning by $\frac{1}{3}$. How much did Jaheel earn during the April quarter?

f) Jamila bought a car for \$5 290. She wanted to sell it after a year and was told its value was $\frac{3}{4}$ of what she paid for it. How much is Jamila's car worth?

Individual Activity 1

Scenario: Julie would like to buy a new computer. She has chosen a brand and found that three different shops are selling it at a discounted price. Shop 1 is selling the computer for \$1349 with a 15% discount, shop 2 is selling it for \$1599 with $\frac{1}{4}$ off for a cash sale and shop 3 is selling it for \$1209 with \$25 off. Julie has saved enough money to pay cash for her computer. Which shop is giving the best deal?

(i) The scenario above involves solving 3 problems. Circle the problems in the information above and rewrite each briefly in the space below:

PROBLEM 1	PROBLEM 2	PROBLEM 3
-----------	-----------	-----------

(ii) Highlight the key information for PROBLEM 1 in green. Highlight the key information for PROBLEM 2 in blue. Highlight the key information for PROBLEM 3 in pink.

(iii) What operations (+, -, \times or \div) are used in each of the problems.

PROBLEM 1	PROBLEM 2	PROBLEM 3
-----------	-----------	-----------

(iv) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to solve these problems?

PROBLEM 1	PROBLEM 2	PROBLEM 3
-----------	-----------	-----------

(v) What strategies can you use to solve these problems?

PROBLEM 1	PROBLEM 2	PROBLEM 3
-----------	-----------	-----------

(vi) Find SOLUTIONS to the problems.

PROBLEM 1	PROBLEM 2	PROBLEM 3
-----------	-----------	-----------

(vii) ARE MY ANSWERS REASONABLE? Use rounding and estimation to verify your results. Check your solutions make sense in terms of the context. Write your answers using the language in the problem.

PROBLEM 1

PROBLEM 2

PROBLEM 3

Reflection and Discussion

How did 'analysing the problem' scenario help you to decide how to solve the problems?



Did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Which sections and why? Share your thinking with others.



How could you change the thinking process table in order to make it more efficient for solving the problem above?

Individual Activity 2

Scenario: Hubert has a job as a sales representative for an internet based company selling advertising. He is paid fortnightly (which is 26 pays each year).

His base salary is \$45 000 per year. He also earns 4% commission on all sales made. Hubert has a monthly sales target of \$12 000 and if he achieves this he earns 8% on every dollar worth of sales over \$12 000.

Hubert pays these tax rates on his salary and commission payments:

Tax on base salary - \$3 572 plus 32.5c for each \$1 over \$37 000

Tax rate on commission amounts - 49%

What is the total amount of tax that Hubert needs to pay on his base salary for the year and how much is this each pay?

These are Hubert's sales figures for the January quarter.

January	February	March
\$10 540	\$9 825	\$13 780

What is the total commission Hubert earned for the January quarter and how much tax must he pay on this?

What is Hubert's total take home pay for the January quarter?

(i) The scenario above involves solving 3 problems. Circle the problems in the information above and rewrite each briefly in the space below:		
PROBLEM 1	PROBLEM 2	PROBLEM 3
(ii) Highlight the key information for PROBLEM 1 in green. Highlight the key information for PROBLEM 2 in blue. Highlight the key information for PROBLEM 3 in pink		
(iii) What operations (+, -, × or ÷) are used in each of the problems.		
PROBLEM 1	PROBLEM 2	PROBLEM 3
(iv) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to solve these problems? Does it require both when solving?		
PROBLEM 1	PROBLEM 2	PROBLEM 3
(v) What strategies can you use to solve these problems?		
PROBLEM 1	PROBLEM 2	PROBLEM 3
(vi) Find SOLUTIONS to the problems.		
PROBLEM 1	PROBLEM 2	PROBLEM 3

(vii) ARE MY ANSWERS REASONABLE? Use rounding and estimation to verify your results. Check your solutions make sense in terms of the context. Write your answers using the language in the problem.

PROBLEM 1

PROBLEM 2

PROBLEM 3

Reflection and Discussion

How did 'analysing the problem' scenario help you to decide how to solve the problems?



Did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Which sections and why? Share your thinking with others.



How could you change the thinking process table in order to make it more efficient for solving the problems above?



This scenario focuses on choosing the correct operation and the best method (mental, calculator or spreadsheet) to solve problems involving decimals and percentages. Complete the following activities to review these skills.

If Hubert sold \$15 300 worth of advertising in April. Write the series of calculations you would use to work out his total commission for the month?



Would you use a mental strategy, calculator or spreadsheet to find the answer? Justify your thinking. Find the total commission amount.



How do you decide when to use a mental strategy, calculator or spreadsheet to solve a problem?



Skills Practice 3

1. Choose the best strategy (mental, calculator or spreadsheet) and then solve the following problems.

a) $\$58.60 + \$7.80 + \$120.95$

d) $\frac{3}{4}$ of 3 006

b) 10% of 4 039

e) Take 25% off \$6 748

c) 32% of \$14 890

f) $12\,050.05 + 1\,399.49 + 307.50$

2. Which operation is required to solve each of the following? Write a number sentence for each and then solve.

a) The fridge costs \$1 799.00, but I get a 20% discount if I pay cash. How much will the fridge cost with the discount?

b) 40 550 people were at the last football derby. 36% of the crowd were Dockers supporters. How many people in the crowd were supporting the Dockers?

c) My weekly net income is \$820. I save a quarter of this so I can buy a car in the future. How much do I have to save each week? How much will I save in a year?

d) Todd has saved \$498 to buy a new couch. If \$500 is $\frac{3}{5}$ of the cost of the new couch, how much more does Todd need to save?

e) The puppy weighed 0.35 kg when it was born. It weighed 2.04 kg at the end of 4 weeks. How much weight did the puppy put on?

f) Oranges cost \$3.52 per kilo. If I bought two and a half kilos, how much would it cost?

Individual Activity 3

Scenario: Design your own table to solve this problem. Decide which steps in the thinking process you need, and which you can do without.

Westez Building Company keeps records of all workplace accidents. The Occupational Health and Safety officer then prepares a bi-annual report on these statistics.

This table of data shows the number of accidents for each of the categories outlined in the table below. This data is for the first 6 months of this year. Westez Building Company employed a total of 732 people across all building projects during this time.

Injury Types	Number
Sprain or strain	50
Cut or open wound	98
Fracture	18
Chronic joint or muscle condition	27
Eye injury	2
Dislocation	0

Cause of injury	Number
Slip, trip or fall	41
Chemicals and other substances	28
Hitting or being hit with an object	59
Lifting, pulling or pushing an object	34
Vehicle incidents	4
Heat, electricity and other environmental factors	29

Location of injury	Number
Hand	66
Back	52
Shoulder	15
Knee	23
Leg	18
Arm	15
Head	6

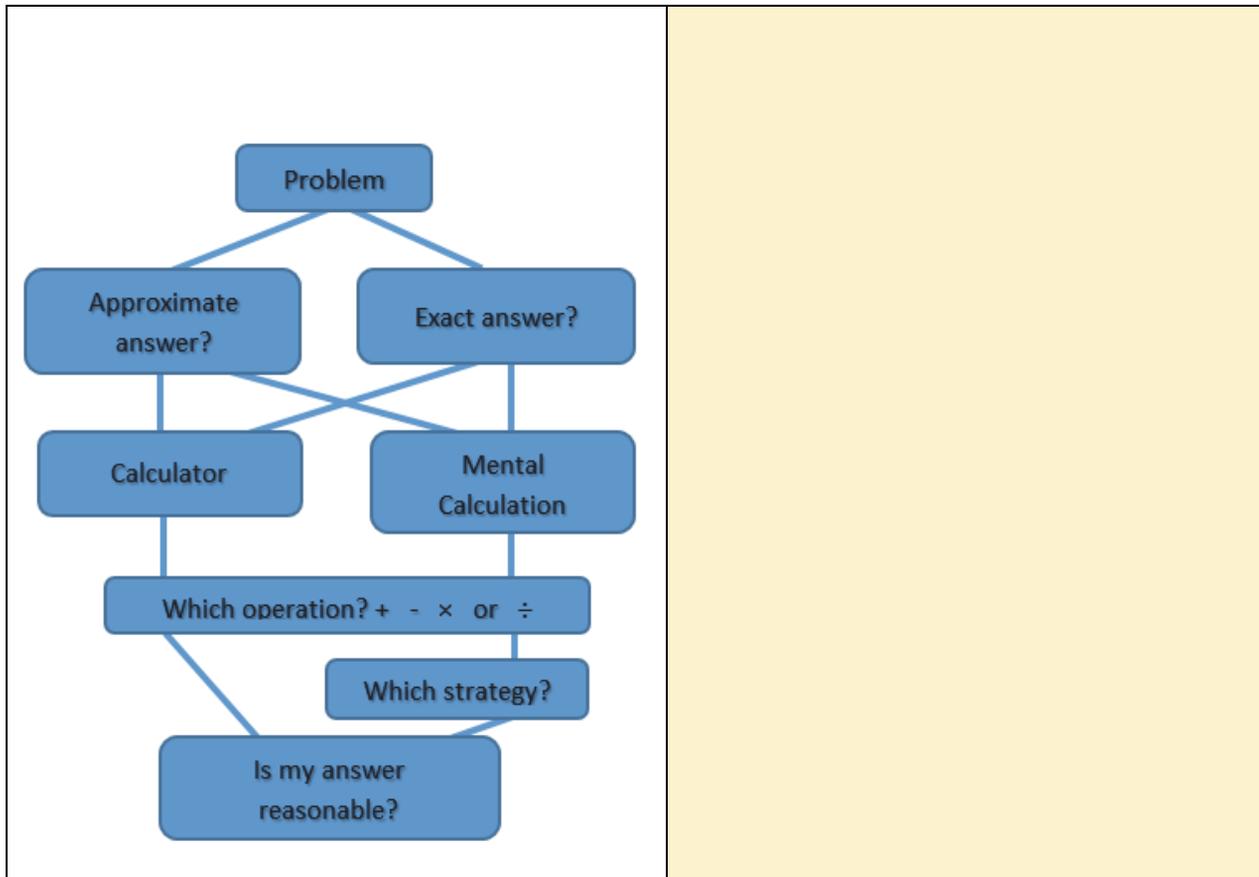
Period of time off work	Number
1 to 6 days	126
1 to 5 weeks	34
6 to 11 weeks	25
12 to 25 weeks	10
26 to 51 weeks	0

Use this data to create a spreadsheet and graph showing the different types of injury and locations of the injuries Westez Building Company employees experienced during the first 6 months of the year.

Write a paragraph to explain the data for the main causes of the injuries and the amount of time people are having to take off as a result of the injuries. Describe the statistics using percentages, decimals and fractions where appropriate.

Reflection and Discussion

Consider the problem in Individual Activity 3. Did your method of solving the problem follow the sequence in the decision making flow chart below? If not, draw a modified version of the decision making flow chart in the box on the right, to show your problem solving sequence.



Reflection on Learning

In which scenarios was it best to use an estimation rather than an exact solution?



In which scenarios did you use a calculator to help solve all parts of the problem? What information in the problem told you that this was the correct method of finding a solution?



Were there any scenarios that you used only mental strategies to solve? If so, which scenarios and what mental strategies did you use?



Which scenario(s) used all four operations (+, -, × or ÷) to solve?



When did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Why?



Self-Assessment

Complete the following self-assessment to focus your attention on your own learning needs.

	What did you find easy?	What did you find hard?	What part do you still need to work on?
Mathematics Thinking Process			
Skills			

Topic 3

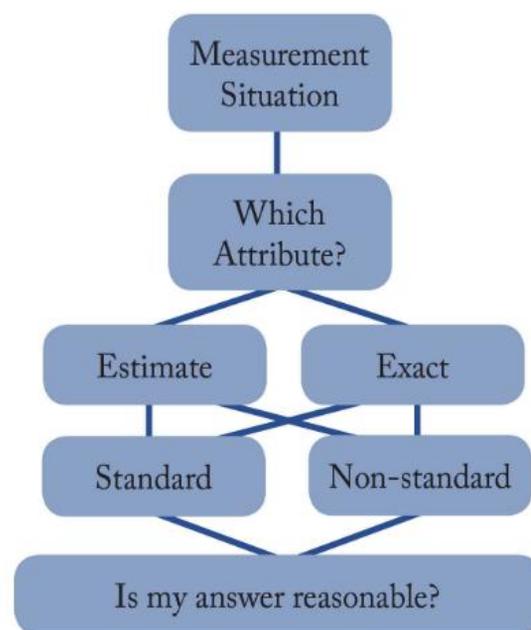
Time and Location

Mathematics Discussion

In most personal, community and workplace contexts, the ability to solve problems involving time is crucial. In order to solve these problems, we need to be able to:

- read analogue and a digital clocks
- use and convert between 12 hour and 24 hour time
- calculate elapsed time
- read and interpret different timetables.

To solve time problems we use the same thinking process (shown in the flow diagram) as for other measurement attributes. This means that we need to make a series of decisions as we work through the problem. Firstly we need to interpret the situation, decide what aspect of time we need to use to solve the problem, decide whether an estimate or an exact answer is needed, what units to use and then after solving the problem, we need to reflect on the answer to ensure that it fits the situation.



In this topic we will also be reading and interpreting maps and plans to solve problems involving direction, distance and travel time. These problems require a slightly different mathematical thinking process from the one above. For example, when deciding which attribute, we choose whether to focus on distance, direction or proximity, or a combination of these. We then decide whether we need to be exact or use an estimation; decide which strategy is required; find a solution and lastly we reflect on the answer to decide whether it is reasonable.

Whole Class Activity 1

SCENARIO: Casey lives with his family in the Perth suburb of Attadale. Every Thursday night, he walks 5 minutes to the 'Wichman Rd after Cawston Rd' bus stop to catch the bus to the Fremantle Bus Station. He then has a 7 minute walk from the Bus Station to a supermarket, where Casey has a casual position stacking shelves. Casey's shift starts at 9 pm.

On Thursday evening, Casey glances at the clock and sees the following time:



Casey wants to work out how much longer he has at home before he has to set off for the bus stop.

He views the following Transperth website to check the latest bus he can catch so as to get to work on time:

<http://www.transperth.wa.gov.au/Journey-Planner>

(i) Rewrite the problem in your own words in the space below:

(ii) Highlight the key information for the PROBLEM in yellow.

(iii) What time and operation skills are required to solve this problem?

(iv) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to solve these problems?
Does it require both when solving?

(v) Is it most efficient to use MENTAL strategies, a CALCULATOR or a SPREADSHEET to solve? Justify your answer.

(vi) Map out Casey's sequence of events leading up to work at 9 pm. Use a timeline if necessary.
Find a SOLUTION.

(vii) IS MY ANSWER REASONABLE? Use rounding and estimation to verify your results.
Check your solution makes sense in terms of the context.
Write your answer using the language in the problem.

(viii) Reflect on the problem. What strategies should Casey use to ensure he gets to work on time?

Reflection and Discussion

What time units will you use to write your solution?



Why did you make this choice?



Skills Practice 1

This scenario concerning Casey's travel to work requires a number of skills involving time. Complete the following to practise this skill set.

1. Draw a minute and an hour hand on the clock faces for each of the following times.

a) Ten past four



c) Five minutes to three



b) Quarter past eight



d) Twenty-three minutes past eleven



2. Read the digital clocks and draw the times on the 12 hour analogue clock. Write the time below each analogue clock in words.

a)



b)



3. Calculate how much time between:

a) 10:00 am and 1:00 pm

b) 11:15 am and 12:20 pm

c) 9:00 am and 1:15 pm

d) 7:42 am and 8:05 am

e) 6:13 pm and 6:54 pm

f) 9:55 pm and 11:15 pm

4. What time is it when it is:

a) 10 mins after 8:10 pm?

b) 15 mins before 7:00 am?

c) 20 mins after 3:45 pm?

d) 30 mins before 4:15 am?

e) 12 mins before 11:00 am?

f) 25 mins after 7:50 am?

5. Below is the Transperth bus timetable from Whitfords Station to Joondalup Station.

Timed Stops					
Stop No.	*	18108	18314	*	
Route No.	Whitfords Stn	Ocean Reef Rd / Eddystone Av	Belridge Senior High School	Joondalup Stn	
Monday to Friday (continued)					
pm	463	5:21	-	5:34	5:50
	464	5:31	5:40	-	5:56
	463	5:35	-	5:48	6:03
	464	5:45	5:54	-	6:10
	463	5:52	-	6:05	6:20
	464	6:02	6:11	-	6:27
	463	6:12	-	6:25	6:40
	464	6:17	6:26	-	6:42
	463	6:37	-	6:49	7:04
	464	6:37	6:46	-	7:00
	464	6:57	7:04	-	7:18
	463	6:57	-	7:08	7:22
	464	7:12	7:19	-	7:32
	463	7:19	-	7:29	7:43
	464	7:39	7:46	-	7:59
	464	8:09	8:16	-	8:30
	464	8:39	8:46	-	9:00
	464	9:09	9:16	-	9:30
	464	10:09	10:16	-	10:30
	464	11:09	11:16	-	11:30
am	464	12:09	12:15	-	12:27

- How much time does it take to travel between Whitfords Station and Joondalup Station via Ocean Reef Rd?
- How long does it take to get from Whitfords Station to Belridge Senior High School?
- Jan needs to be at Belridge Senior High School at 6 pm for the school play. What is the latest bus she can catch from Whitfords Station?
- McKenzie needs to be at Joondalup Station at 8:45 pm. What is the latest bus she can catch from Ocean Reef Road?
- George leaves home at 5:33 pm and walks 5 minutes to Whitford Station. He then catches the next available bus to Joondalup Station. How long is it between George leaving home and arriving at Joondalup Bus Station? You may wish to draw a timeline to show your thinking.
- Jan finishes netball training at Belridge Senior High School at 5:40 pm. She catches the next bus to Joondalup Station and then walks 8 minutes to get home. What time does Jan get home? You may wish to draw a timeline to show your thinking.

Small Group Activity

SENARIO: Casey’s Grandparents are staying at a hotel in McMahons Point in Sydney. Casey asks them to meet him in the Rocks area at 7:30 pm on a Saturday night to go out for dinner. He tells them it is a 10 minute walk to the train station from their hotel. From there they can catch a train from North Sydney Station, North Sydney to Circular Quay, Harbour Master Steps, The Rocks. Casey will be at the train station in the Rocks to meet them.

Use the New South Wales train timetable link below, to calculate the latest time they can leave their hotel in order to meet Casey on time.

http://tp.transportnsw.info/nsw/XSLT_TRIP_REQUEST2

When they arrive at the train station in the Rocks, they get a phone call from Casey to say he is running late and could they meet him at the restaurant on the corner of Cumberland St and Argyle St in the Rocks.

Locate the train station and the restaurant location using Google Maps. Print a copy of the map and circle the start and finish points of this journey. Staple the printed map to the side of this page. What direction will they be walking in and for how long, in order to get to the restaurant?

(i) The scenario above involves solving two problems. Circle each problem in the information and rewrite them in your own words in the space below:	
PROBLEM 1	PROBLEM 2
(ii) Highlight the key information for PROBLEM 1 in yellow. Highlight the key information for PROBLEM 2 in blue.	
(iii) What time, operations and map reading skills are used in each of the problems?	
PROBLEM 1	PROBLEM 2
(iv) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to solve these problems? Does it require both when solving?	
PROBLEM 1	PROBLEM 2
(v) Is it most efficient to use MENTAL strategies, a CALCULATOR or a SPREADSHEET to solve? Justify your answer.	

(vi) What strategies can you use to solve these problems?	
PROBLEM 1	PROBLEM 2
(vii) Write the SOLUTION below.	
PROBLEM 1	PROBLEM 2
(viii) ARE MY ANSWERS REASONABLE? Use rounding and estimation to verify your results. Check your solutions make sense in terms of the context. Write your results using the language in the problem.	
PROBLEM 1	PROBLEM 2
(ix) Reflect on the problem. What is the best way that Casey can present his written instructions to his Grandparents?	

Reflection and Discussion

Did you focus on distance, direction or proximity, or a combination of these, to solve this problem?



Why did you make this choice?



Did you need to focus on the attribute of time? Why or why not?



Skills Practice 2

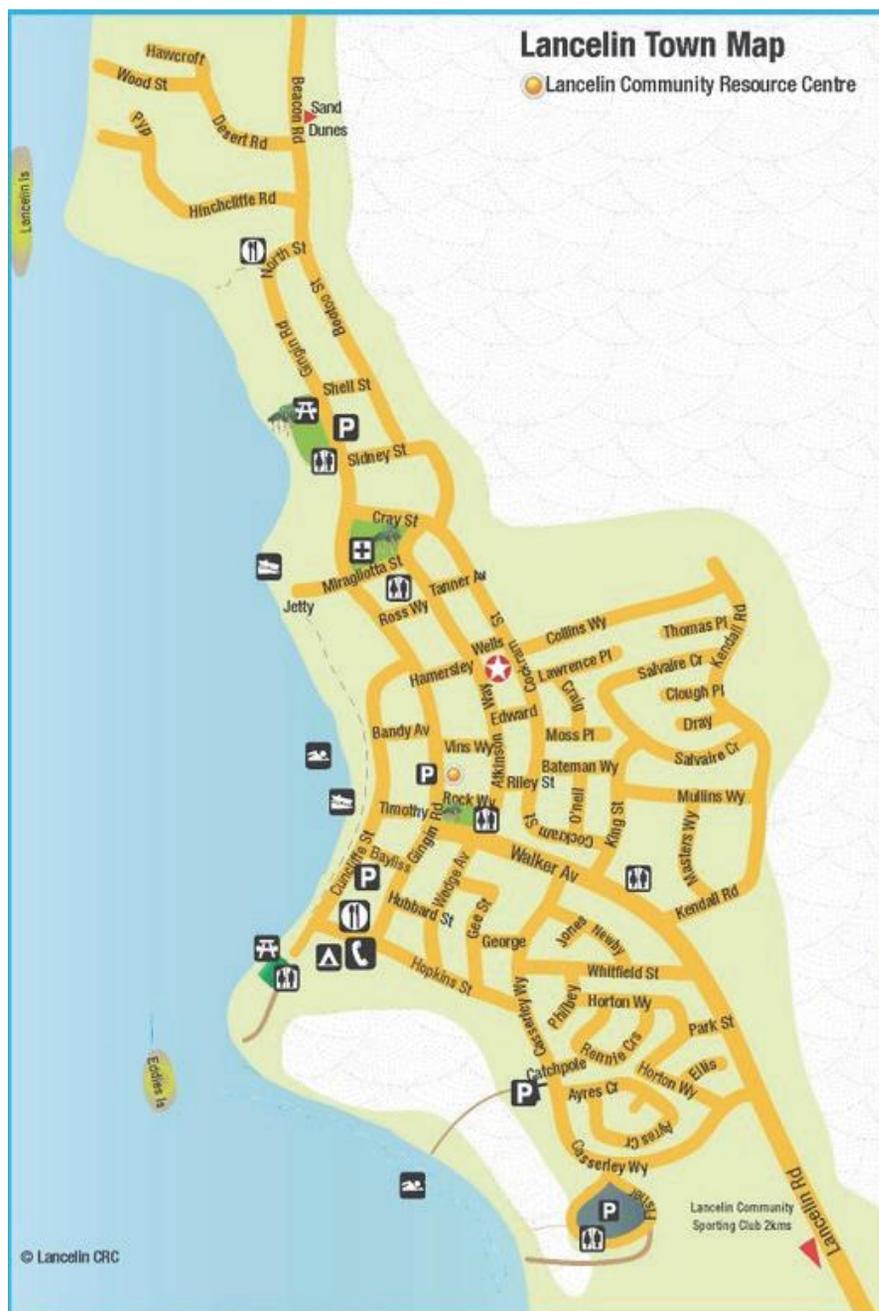
1. Convert the following to 24 hour time:

- | | |
|-------------|------------|
| a) 10:20 am | d) 1:15 pm |
| b) 1:30 am | e) 4:56 pm |
| c) 12 noon | f) 8:24 pm |

2. Find the elapsed time between:

- | | |
|------------------|------------------|
| a) 0700 and 1100 | d) 1425 and 1500 |
| b) 1000 and 1315 | e) 1900 and 2135 |
| c) 0915 and 1120 | f) 1245 and 1615 |

3. Use the map of Lancelin, a town in the Midwest of Western Australia, to solve the following.



- a) If you were on the corner of Mullins Way and Kendall Rd, what street would you meet if you travelled west?
- b) What direction does Whitfield St run?
- c) What direction are you travelling, if you go from the parking lot at Catchpole St to the telephone booth on Hopkins St?
- d) If you leave the restaurant on North St and immediately travel in a South East direction, what street would you be travelling on?
- e) Lancelin Rd, travelling North-West, turns into which road?
- f) Write directions for getting from the toilets on Sidney St to the Sand Dunes.

4. Use Google maps: <https://www.google.com.au/maps> to write the direction of travel and shortest times to:

- a) Walk from the Fremantle Markets to Bathers Beach in Fremantle.
- b) Drive from Horrocks Beach Caravan Park in Western Australia to Northampton in Western Australia.
- c) Cycle from the Melbourne Cricket Ground in Melbourne to Federation Square in Melbourne.
- d) Catch the train from Glenelg Beach tram stop in Adelaide after 2 pm to get to Rundle Mall, Adelaide.

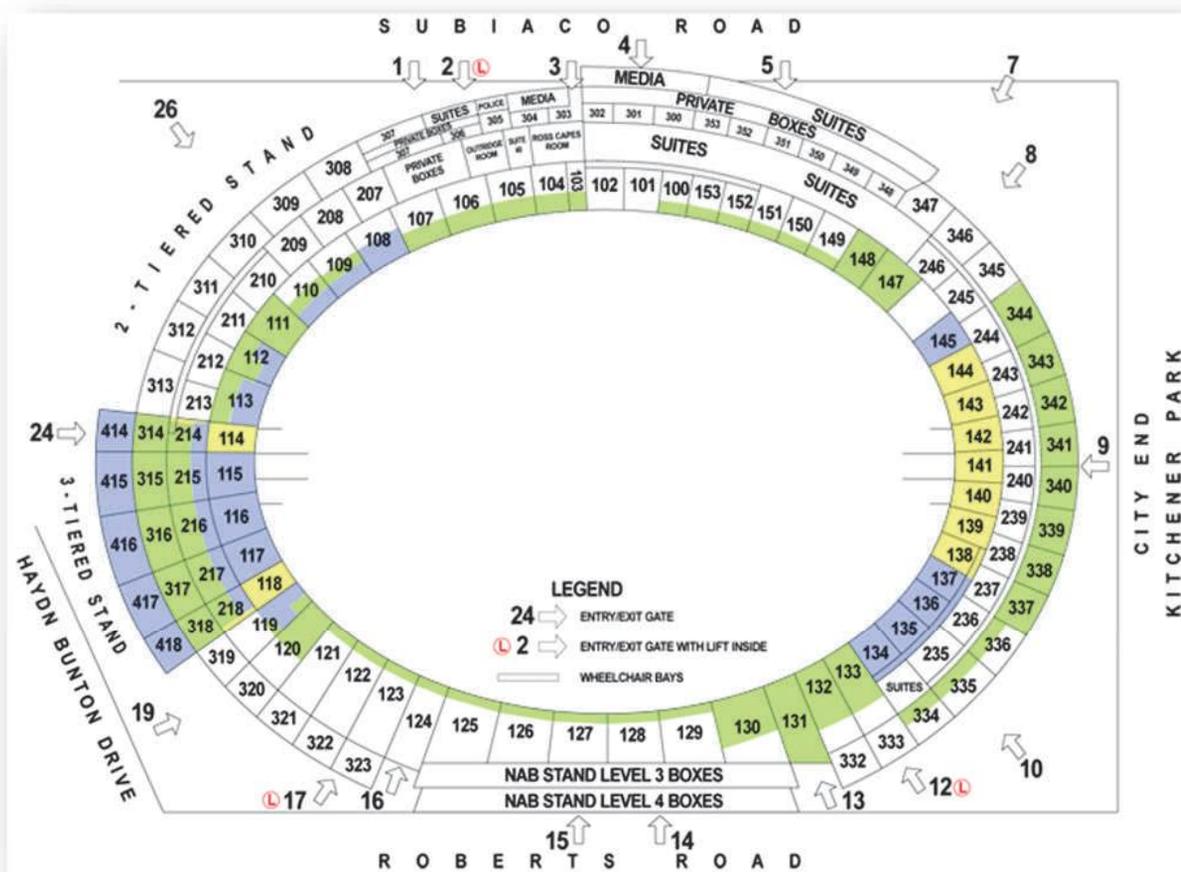
5. Download and print a town map of Esperance, Western Australia to calculate the following:
<http://www.whereis.com/wa/esperance-6450>

- a) The length of The Esplanade between the railway lines.
- b) The length of Brazier St.
- c) The distance between Curtin University and the T- junction of Pink Lake Road and Harbour Road.
- d) The distance between Nulsen Primary school and Esperance Bay Caravan Park via the shortest route.
- e) The direct distance from Rotary Lookout to Museum Park.
- f) The distance from Rotary Lookout to Museum Park via the road.

6. Draw a mud map to show a friend how to get from your home to the nearest park. Write estimated times for each stage of the journey. How long does it take you to travel from home to your nearest park?

Individual Activity 1

SCENARIO: Casey and a friend are going to watch a football match at Domain Stadium in Perth. The game starts at 2:30 pm and is played over four, twenty minute quarters with 5 minute breaks at the quarter times and a 20 minute break at halftime. Both friends like to be at the game 45 minutes before the commencement of the match. Casey parks his car at his friend's house in Carlton St, West Leederville and they walk together to the football ground. Casey's ticket is C3 in Bay 111 and his friend's ticket is H4 in Bay 243. They plan to meet at half time, at a bay midway between their seats.



Domain Stadium Seating Map
 (Retrieved from: http://www.austadiums.com/stadiums/stadiums_seating.php?id=109)

How much time will Casey and his friend be away from the Carlton St house? What gates should they enter to find their seats? What bay should they meet near at half time?

(i) The scenario above involves solving 3 problems. Circle the problem(s) in the information above and rewrite each briefly in the space below:		
PROBLEM 1	PROBLEM 2	PROBLEM 3
(ii) Highlight the key information for PROBLEM 1 in yellow. Highlight the key information for PROBLEM 2 in pink. Highlight the key information for PROBLEM 3 in blue.		
(iii) What time, operations or map/plans skills are in the problems?		
PROBLEM 1	PROBLEM 2	PROBLEM 3
(iv) Are APPROXIMATE ANSWERS or EXACT ANSWERS needed to solve these problems? Does it require both when solving?		
PROBLEM 1	PROBLEM 2	PROBLEM 3
(v) What strategies can you use to solve these problems?		
PROBLEM 1	PROBLEM 2	PROBLEM 3
(vi) Find SOLUTIONS to the problems.		
PROBLEM 1	PROBLEM 2	PROBLEM 3
(vii) ARE YOUR ANSWERS REASONABLE? Use rounding and estimation to verify your results. Check your solutions make sense in terms of the context. Write your answer using the language in the problem.		
PROBLEM 1	PROBLEM 2	PROBLEM 3

Skills Practice 3

1. Calculate the following answers in hours and minutes.
 - a) 30 minutes + 10 minutes + 30 minutes
 - b) 1 hour and 25 minutes + 2 hours and 20 minutes
 - c) 4×30 minutes
 - d) 4×15 minutes + 20 minutes
 - e) 2×20 minutes + 2×30 minutes
 - f) 2 hours \div 8

2. Use the Store Directory and Map of Garden City Shopping Centre in Booragoon, Western Australia to answer the following questions:
<https://www.gardencity.com.au/centre>
 - a) What store is located at E9?
 - b) Where is the '1 Hour Quick Park' located?
 - c) How many stalls are in G3?
 - d) What street would you enter from for 'Parcel Pick Up'?
 - e) How many ATM's are in the shopping centre?
 - f) What direction is Myer from JB Hi Fi?
 - g) What direction should you walk to get from Woolworths to David Jones?

 - h) Your friend is lost and cannot find you. They ring and say they are at the Wizard Pharmacy near Kmart. You are at the food court. What directions would you give your friend so they can get to you at the food court?

 - i) Calculate the distance between K Mart and Myer. Why is this difficult?

 - j) Is this a map or a plan? What is the difference?

Individual Activity 2

Create your own problem solving tables to solve the following scenario.

SCENARIO: Peter and Sol are driving a semi-trailer truck loaded with a second hand fibre glass pool from Dunsborough to Geraldton. They leave Dunsborough at 8.45 am on a Monday and plan to travel at an average speed of 60 km/h. What time should they expect to arrive in Geraldton?

Individual Activity 3

Create your own problem solving tables to solve the following scenario.

SCENARIO: Casey is having friends over for a roast dinner. He would like to start plating up the meal at 6:50 pm to serve it at 7 pm. The cooking and preparation times for each part of his meal are as follows:

INGREDIENT	PREPARATION TIME	COOKING TIME
Chicken	10 mins	$1\frac{1}{2}$ hours
Potatoes	10 mins	45 mins
Peas	1 min	5 mins
Cauliflower Cheese	20 mins	25 mins
Carrots	5 mins	15 mins

At what time should Casey start preparing and cooking each of the ingredients?

Reflection on Learning A

In which scenarios did you approximate time?

In which scenario was exact time crucial?

When is using exact time in everyday situations vital? Explain your thinking?



Did you use mental strategies, a calculator or a spreadsheet to solve the problems in this topic? Which of these is used most in everyday life? Explain your thinking.



What mathematics did you use in this topic? What strategies did you use?



What strategies did you use to check whether your answers were reasonable?



Reflection on Learning B

Reflect back on your day. Where and when did you read a clock? What type of clock do you read most often?



List as many instances as you can, where timetables are used?



In which scenarios did you need to develop your own timetable?



List as many instances as you can where 24 hour time is used?



Why is being able to calculate elapsed time important in everyday life?



What type of maps did you use in this topic?



When in everyday life, is it important to be able to read a map or plan?



Self-Assessment

Complete the following self-assessment to focus your attention on your own learning needs.

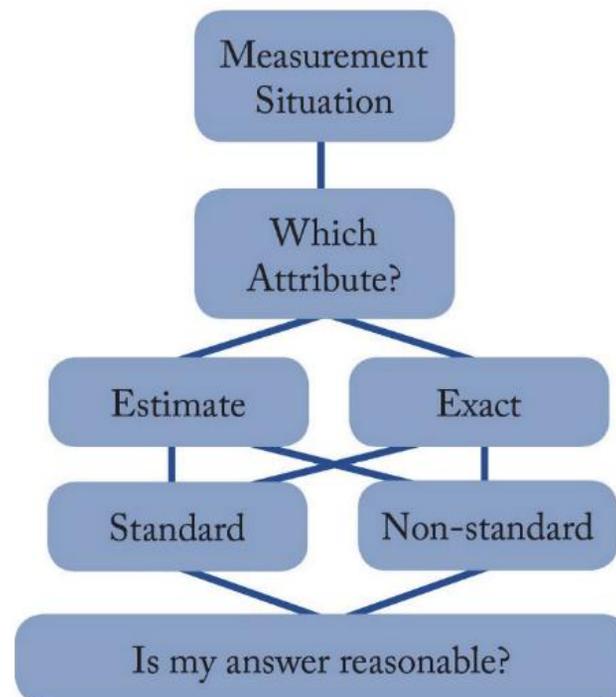
	What did you find easy?	What did you find hard?	What part do you still need to work on?
Mathematics Thinking Process			
Skills			

Topic 4

Measurement: Estimating and Calculating

Mathematics Discussion

When solving everyday problems involving measurement, we work through a decision making process outlined in the flow diagram below:



Sometimes we work through the thinking process in the order shown in the diagram above. Sometimes we need to jump a step and come back to it later.

When solving measurement problems we need to analyse the situation to decide which attribute or attributes to focus on in order to solve it. Do we focus on length, mass, capacity, perimeter, area or volume? Then we need to decide how accurate to be, and this will help us to decide which unit to use. The more accurate we need to be the smaller the unit we should use. After solving a problem, we should always think about whether the answer makes sense and is reasonable for the situation. Sometimes this means that we need to redo parts of our solution.

Whole Class Activity 1

Scenario: Paint is on special for \$52.90 for a 4 litre tin. The paint coverage rate is 16 m² per 1 litre of paint. Each wall will need two coats of paint.

Imagine you have been given permission to paint the classroom walls, within a budget of \$250.

How many tins of paint will you need to paint the walls and will the cost of the tins be within the budget? (HINT: you do not need to paint the windows or doors.)

(i) The scenario above involves solving two problems. Circle each problem in the information and rewrite them in your own words in the space below:	
PROBLEM 1	PROBLEM 2
(ii) Highlight the key information for the PROBLEM 1 in yellow. Highlight the key information for the PROBLEM 2 in blue.	
(iii) Which attributes of measurement does this problem involve?	
PROBLEM 1	PROBLEM 2
(iv) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to for this measurement situation? Does it require both when solving?	
PROBLEM 1	PROBLEM 2
(v) Are STANDARD or NON-STANDARD units needed for this measurement situation? What units will you use?	
PROBLEM 1	PROBLEM 2
(vi) Is it most efficient to use MENTAL strategies, a CALCULATOR or a SPREADSHEET to solve? Justify your answer.	
PROBLEM 1	PROBLEM 2

(vii) SOLVE the problem showing your thinking and measurements with a diagram of the situation.

PROBLEM 1

PROBLEM 2

(viii) IS MY ANSWER REASONABLE? Use rounding and estimation to verify your results. Check your solution makes sense in terms of the context. Write your answer using the language in the problem.

PROBLEM 1

PROBLEM 2

(ix) Reflect on the problem. Can the room be painted within the budget constraint?

Reflection and Discussion

How did 'deciding which attribute' help you to decide how to solve the problem?



Did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Which sections and why? Share your thinking with others.



Describe the level of accuracy required for this scenario and justify why you have described it this way.



Did you use a formula to calculate the amount of paint needed to cover the walls?
Why? Why not?



How did you use estimation when solving this scenario?

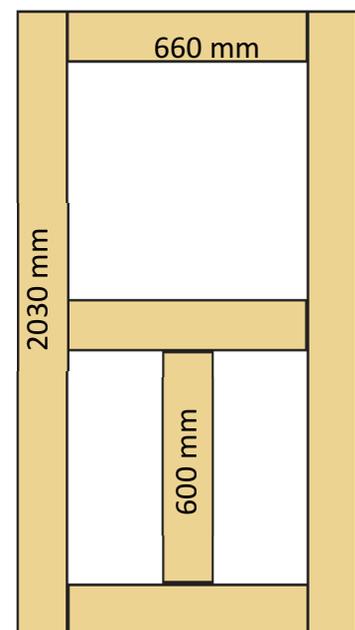


Skills Practice 1

The scenario for painting the classroom involved a number of skills involving area. Complete the following questions to practice these skills.

1. Use the pictures to solve the problems.

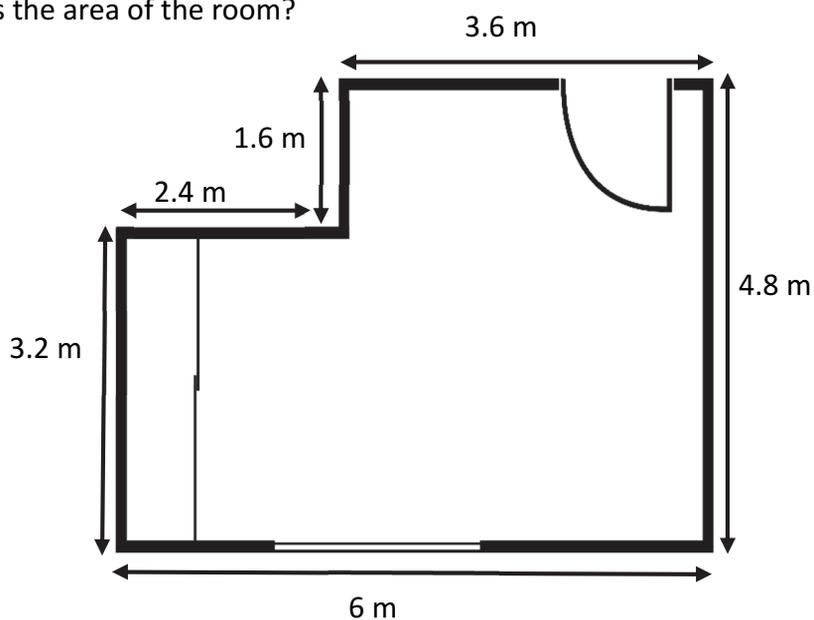
a) Here is a plan for making a screen door using 80 mm wide timber.
How many lineal metres of wood are needed to make the door?



b) Approximately how much screening material will be needed to fill the spaces in the door?

c) Here are the measurements for a bedroom.

What is the area of the room?



d) This is an aerial view of a paddock with its dimensions. What is the area of the paddock?

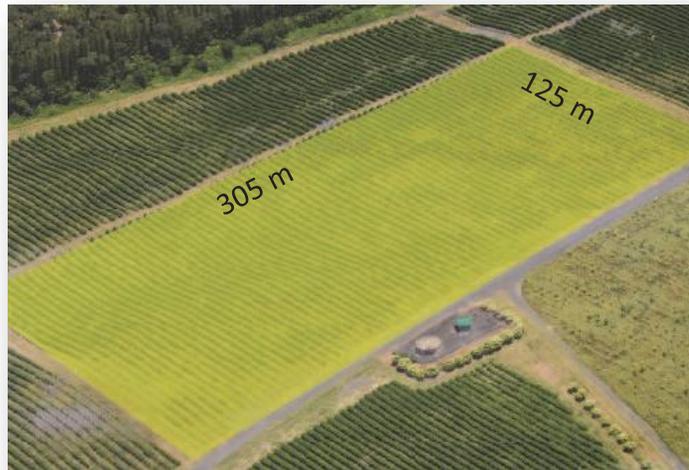


Photo by Nathan Forget, retrieved from <https://goo.gl/yWvpyC>

2. Use the dimensions to calculate the area.

a) A bedroom floor is 3.8 m by 4.2 m. How many square metres of timber laminate is needed to cover the floor?

b) A patio area is 4050 mm by 2500 mm. How many squares metres of paving is needed to cover the space?

c) A bathroom floor is 4.8 m by 2.7 m. How many square metres of tiles will be needed for the floor?

d) A shopping centre carpark is 1.6 km long and 0.5 km wide. What is the area of the carpark?

e) The stage area at the concert hall is 27m^2 . What might the dimensions be?

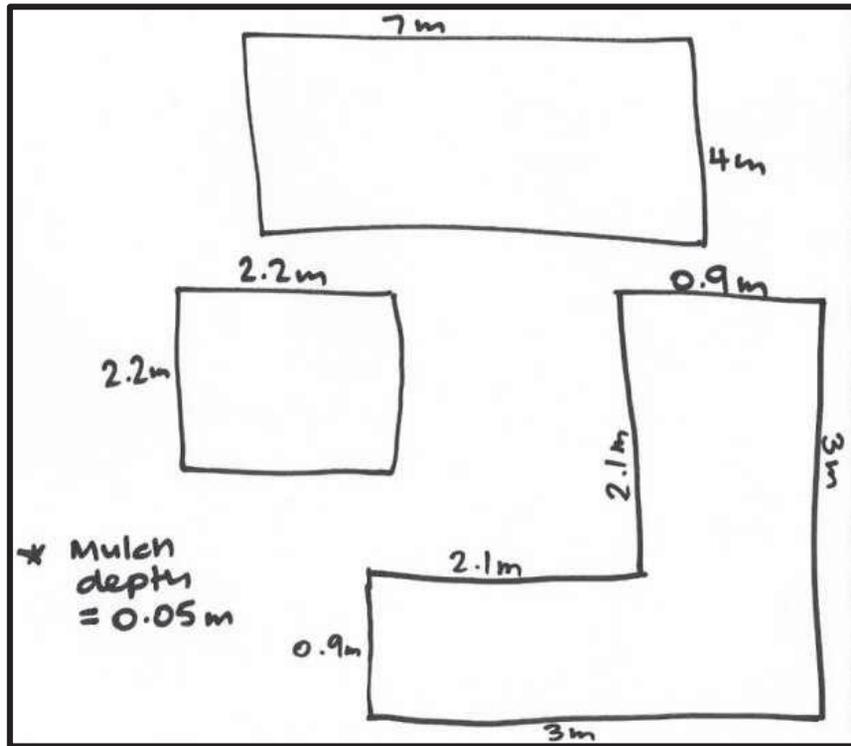
f) A horse should be kept in a paddock that is at least 3 m wide and has an area of at least 20m^2 . List 3 different sets of dimensions a paddock could be, meeting these regulations.

Small Group Activity 1

Scenario: Jess is helping her Nanna mulch her garden. Jess needs to work out how many cubic metres of mulch to order from the garden centre. She also needs to decide if the mulch can be picked up in a trailer or if it is better to have it delivered.

She has sketched out the garden beds and jotted down the measurements. The mulch needs to be 5 cm deep.

Jess decides that while she is mulching the garden she will install some reticulation sprinklers around the edge of each garden bed. How much pipe will she need?



(i) The scenario above involves solving two problems. Circle each problem in the information and rewrite them in your own words in the space below:

PROBLEM 1	PROBLEM 2
-----------	-----------

(ii) Highlight the key information for PROBLEM 1 in yellow.
Highlight the key information for PROBLEM 2 in green.

(iii) Which attributes of measurement do these problems involve?

PROBLEM 1	PROBLEM 2
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<p>(iv) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to for this measurement situation? Does it require both when solving?</p> <table border="1" data-bbox="178 304 1361 490"> <tr> <td data-bbox="178 304 789 490">PROBLEM 1</td> <td data-bbox="789 304 1361 490">PROBLEM 2</td> </tr> </table>	PROBLEM 1	PROBLEM 2
PROBLEM 1	PROBLEM 2	
<p>(v) Are STANDARD or NON-STANDARD units needed for this measurement situation? What units will you use?</p> <table border="1" data-bbox="178 599 1361 785"> <tr> <td data-bbox="178 599 789 785">PROBLEM 1</td> <td data-bbox="789 599 1361 785">PROBLEM 2</td> </tr> </table>	PROBLEM 1	PROBLEM 2
PROBLEM 1	PROBLEM 2	
<p>(vi) Is it most efficient to use MENTAL strategies, a CALCULATOR or a SPREADSHEET to solve? Justify your answer.</p> <table border="1" data-bbox="178 890 1361 1048"> <tr> <td data-bbox="178 890 789 1048">PROBLEM 1</td> <td data-bbox="789 890 1361 1048">PROBLEM 2</td> </tr> </table>	PROBLEM 1	PROBLEM 2
PROBLEM 1	PROBLEM 2	
<p>(vii) SOLVE the problems, showing your thinking.</p> <table border="1" data-bbox="178 1117 1361 1412"> <tr> <td data-bbox="178 1117 789 1412">PROBLEM 1</td> <td data-bbox="789 1117 1361 1412">PROBLEM 2</td> </tr> </table>	PROBLEM 1	PROBLEM 2
PROBLEM 1	PROBLEM 2	
<p>(viii) IS MY ANSWER REASONABLE? Use rounding and estimation to verify your results. Check your solution makes sense in terms of the context. Write your answer using the language in the problem.</p> <table border="1" data-bbox="178 1598 1361 1838"> <tr> <td data-bbox="178 1598 789 1838">PROBLEM 1</td> <td data-bbox="789 1598 1361 1838">PROBLEM 2</td> </tr> </table>	PROBLEM 1	PROBLEM 2
PROBLEM 1	PROBLEM 2	
<p>(ix) Reflect on the problem. Could this amount of mulch be carried in a trailer?</p>		

Reflection and Discussion

How did 'deciding which attribute' help you to decide how to solve the problem?



Did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Which sections and why? Share your thinking with others.



Describe the level of accuracy required for this scenario and justify why.



Did you use a formula to calculate the amount of mulch needed to cover the garden beds? Why? Why not?



Did you use a formula to calculate the amount of pipe needed to go around the garden beds? Why? Why not?



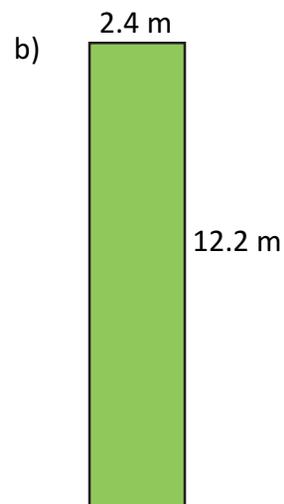
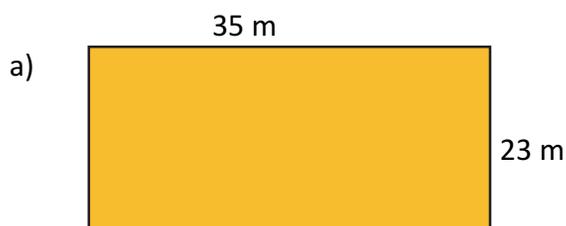
How did you use estimation when solving this scenario?



Skills Practice 2

The scenario above involves the attributes of volume and perimeter. Complete the following questions to practise these skills.

1. Use the diagrams and measurements to calculate the perimeter.

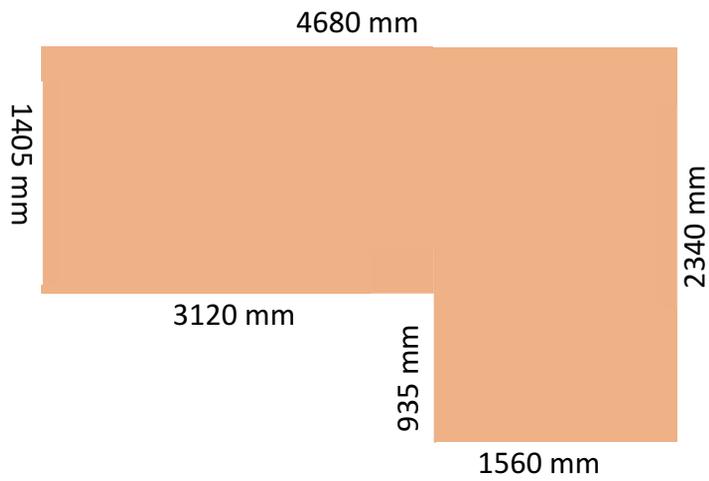


c)



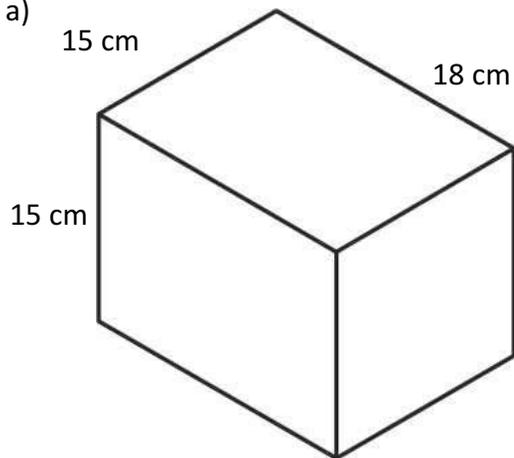
Photo by Bill Wilson, retrieved from <https://goo.gl/j1sTrt>

d)

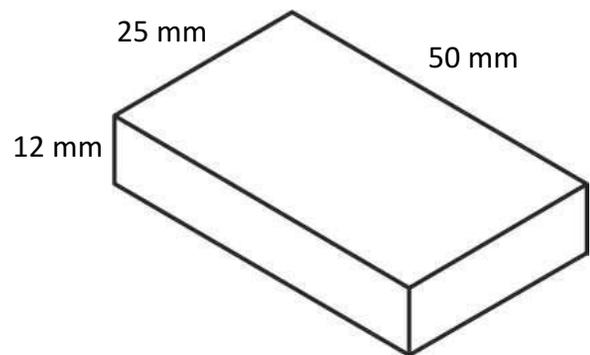


2. Use the diagram and measurements to calculate the volume of each object.

a)



b)

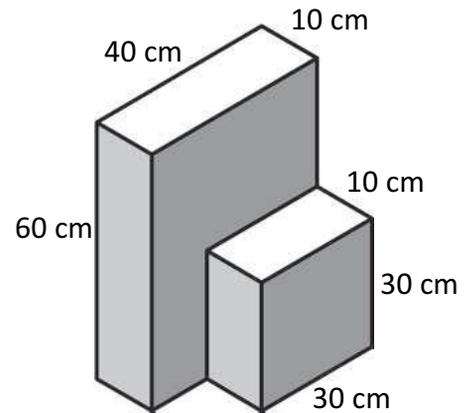


c)



Photo by Joi Ito, retrieved from <https://goo.gl/zUvHnJ>

d)



3. For each situation below, decide if you are finding perimeter or volume measurements and then calculate.

a) Harry is making a frame for a piece of artwork. The artwork is 400 mm wide and 700 mm tall. How much framing does Harry need for the project?

b) Jirah is putting in a feature tile around the walls of the bathroom. The bathroom is a square, with all sides being 3.1 m long. How many lineal metres of feature tile does Jirah need to purchase?

c) How much compost will the compost bin hold when it is full? The compost bin is 1 metre wide, 1.5 metres tall and 0.8 metres deep.

d) How much skirting board is needed to replace the old one in the lounge room if the rectangular room is 5300 mm by 4050 mm?

e) How much dirt has been dug out to create a hole for the swimming pool if the pool dimensions are 9 m x 2.5 m x 1.4 m?

f) How much wire will be required to fence off the environmental restoration areas at the mine? There are two areas, both rectangular and 1.3 km x 2.1 km in size.

Small Group Activity 2

Create your own problem solving table to solve the following scenario.

Scenario: The Water Corporation website says “turn off the tap when brushing your teeth and reduce wasted water – 8 out of 10 people have adopted this habit, have you?”

The Colgate website says “Many dentists agree that proper brushing takes at least two minutes.”

How much water is wasted if you leave the tap on while brushing your teeth?

Put a bucket under a tap and catch the water for 2 minutes. Measure it.

Use this to work out how much water is used by one person to clean their teeth per year?

What is the quantity of water equivalent to?

How much water could be saved per year, if the tap is turned on only when it is absolutely necessary?

Reflection and Discussion

How did ‘deciding which attribute’ help you to decide how to solve the problem?



Did you need to revise your thinking after asking yourself ‘Is my Answer Reasonable?’ Which sections and why? Share your thinking with others.



Describe the level of accuracy is required for this scenario and justify why.



How much water does a dripping tap waste in a day? How could you work this out without waiting a whole day?



Skills Practice 3

1. How much water is used in the following scenarios?

a) A water saving shower-head outputs 9 litres of water per minute. If you have a 10 minute shower every day, how much water are you using in the shower each year?

b) A water efficient washing machine can use 50 litres less water each load than an inefficient one. If you do 6 loads of washing each week, how much water is this each week?

c) A leaking tap was dripping at a rate of 62 mL per minute. How much water would be wasted each day?

d) When waiting for the shower water to warm up, catch the water in a bucket and use for watering plants. If 2.8 litres of water is collected each day, how much water is this in one week?

e) A water efficient, dual flush toilet uses 3 litres of water for a half flush and 4.5 litres for a full flush. One household worked out that on an average day they use 13 half flushes and 4 full flushes. How much water is this?

f) If you collect the 1500 mL of water that comes from the kitchen tap as you wait for it to heat up, how many 250 mL glasses of water will this fill?

Small Group Activity 3

Create your own problem solving table to solve the following scenario.

Scenario: Travis works in a fruit packing shed, packing avocados. The avocados are packed in boxes and the weight of a full box ranges from 5.8 to 7.5 kg. Each box is 18 cm tall. The boxes of avocados are then stacked onto pallets, and once the pallet is full they are packed onto a truck using a forklift. The maximum height of the boxes on a full pallet must not exceed 2 m. Four stacks of boxes will fit on the pallet.

This sign is on the wall of the packing shed telling people how they should safely move the boxes, according to how heavy they are.

How many full boxes of avocados could a person carry?

How many boxes will fit the height restrictions of the pallet?

How many boxes will fit on the pallet and what is the approximate weight of the full pallet?



Reflection and Discussion

How did 'deciding which attribute' help you to decide how to solve the problem?



Did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Which sections and why? Share your thinking with others.



Describe the level of accuracy is required for this scenario and justify why.



How did you use estimation in to solve the problem or check if you had a reasonable answer?



Skills Practice 4

1. Solve each problem involving mass.

a) At a gold mine, each bucket of rock on the front end loader weighs 0.45 tonnes. If a haul pack can carry 400 tonnes, how many buckets of rock will fill it?

b) A baby weighs 3720 g when it is born. After two months it weighs 6480 g. How much weight did the baby gain?

c) This season a farm's yield of wheat was 3720 tonnes. Last year it was 1940 tonnes? How much more wheat was harvested this year?

d) I bought 2.5 kg of oranges, 0.3 kg of apples and 1.1 kg of pears. How many kilograms of fruit did I buy?

e) How many 48 g rolls can be made from 2690 g of bread dough?

f) If the horse eats 0.75 kg of *Sunflower Gold* each day. How much will it eat each month?

Individual Activity 1

Scenario: Shae bought a DIY shed with these dimensions.

Width: 3 000 mm Depth: 2 260 mm Height: 2 000 mm

He needs to lay a concrete slab for the shed to sit on. The concrete slab must be 100 mm thick. Before pouring the concrete Shae must make a wooden frame for the concrete to sit inside. The shed will sit on the edge of the concrete.

How much wood is needed for the frame? How much concrete is needed for the slab?

(i) The scenario above involves solving 2 problems. Circle the problems in the information above and rewrite each briefly in the space below:	
PROBLEM 1	PROBLEM 2
(ii) Highlight the key information for PROBLEM 1 in blue. Highlight the key information for PROBLEM 2 in green.	
(iii) Which attributes of measurement are does this problem involve?	
PROBLEM 1	PROBLEM 2
(iv) Is an APPROXIMATE ANSWER or EXACT ANSWER needed to for this measurement situation? Does it require both when solving?	
PROBLEM 1	PROBLEM 2
(v) Are STANDARD or NON-STANDARD units needed for this measurement situation? What units will you use?	
PROBLEM 1	PROBLEM 2

(vi)	Is it most efficient to use MENTAL strategies, a CALCULATOR or a SPREADSHEET to solve? Justify your answer.	
PROBLEM 1	PROBLEM 2	
(vii)	SOLVE the problems, showing your thinking.	
PROBLEM 1	PROBLEM 2	
(viii)	IS MY ANSWER REASONABLE? Use rounding and estimation to verify your results. Check your solution makes sense in terms of the context. Write your answer using the language in the problem.	

Reflection and Discussion

When making concrete, it is recommended that you add extra 10% to the total volume to allow for wastage. How much concrete would be needed if you made an extra 10%?



How did 'deciding which attribute' help you to decide how to solve the problem?



Did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Which sections and why? Share your thinking with others.



Describe the level of accuracy required for this scenario and justify why.



Did you use any formulas to calculate the amount of concrete or wood required? Why/why not?



Individual Activity 2

Create your own problem solving table to solve the following scenario.

Scenario: Tim is working on a farm that grows barley. Zinc needs to be added to the soil. It must be mixed with water in a 5400 L mixing tank so it can then be sprayed. The table below shows the rates of Zinc and Water that must be applied per hectare. The farm is growing 126 hectares of barley.

Zinc	Water
6 L per hectare	80 L per hectare

How many litres of water and zinc are needed to cover the barley crop?

Will this amount fit into the 5400 L mixing tank?

The Zinc product is bought in 200 L and 1000 L amounts; what quantities should be purchased?

Reflection and Discussion

How did 'deciding which attribute' help you to decide how to solve the problem?



Did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Which sections and why? Share your thinking with others.



Describe the level of accuracy required for this scenario and justify why.



Did you use any formulas to solve the problem? Why/why not?

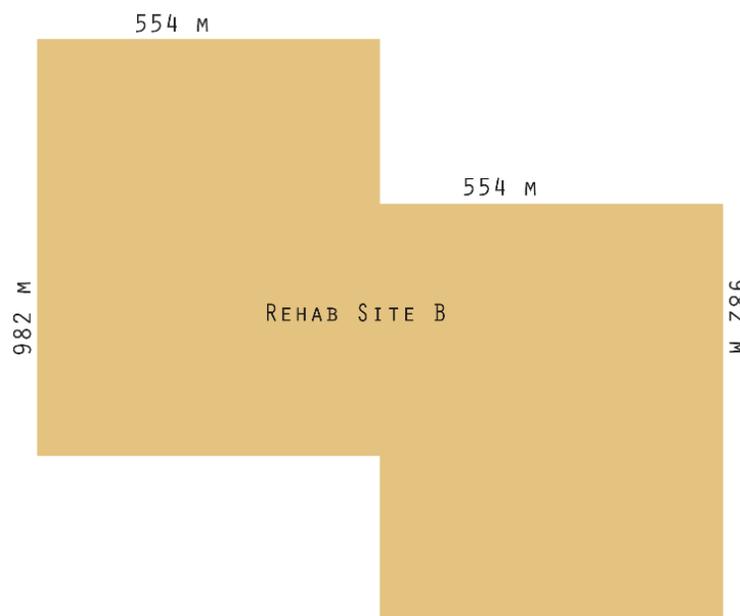


Individual Activity 3

Create your own problem solving table to solve the following scenario.

Scenario: An area of a mine site needs rehabilitating with vegetation. Before plants can be planted the site must be prepared by adding topsoil, organic matter and fertiliser.

Here is a plan of the site that needs rehabilitation.



This table shows the quantities and costs for each component needed for the rehabilitation.

Item	Quantity per 1000 m ²	Cost per 1000 m ²
Topsoil	0.3 m depth	\$870
Organic matter	1 tonne	\$60
Fertiliser	10 kg	\$20

Calculate how much of each item is required and how much each will cost.

Reflection on Learning A

In which scenarios in this topic did you use approximate measurements?

In which scenarios was exact measurement crucial?

When is using exact measurement in everyday situations vital? Explain your thinking?



Were the scenarios in this topic solved by mental strategies, a calculator or a spreadsheet? Which of these is used most in everyday life? Explain your thinking.



What mathematics did you use in this topic? What strategies did you use?



What strategies did you use to check whether your answers were reasonable?



Reflection on Learning B

Reflect back on your week. Where and when did you use measurement? What type of measurement do you use most often?



List as many instance as you can, where length measurements are used?



List as many instances as you can where volume measurements are used?



List as many instances as you can where capacity measurements are used?



List as many instances as you can where mass measurements are used?



Self-Assessment

Complete the following self-assessment to focus your attention on your own learning needs.

	What did you find easy?	What did you find hard?	What part do you still need to work on?
Mathematics Thinking Process			
Skills			

Topic 5

Measurement: Relationships Between Metric Units

Mathematics Discussion

When solving everyday problems involving measurement, we work through a decision making process outlined in the flow diagram below:

Sometimes we work through the thinking process in the order shown in the diagram above. Sometimes we jump a step and come back to it later or omit it altogether.

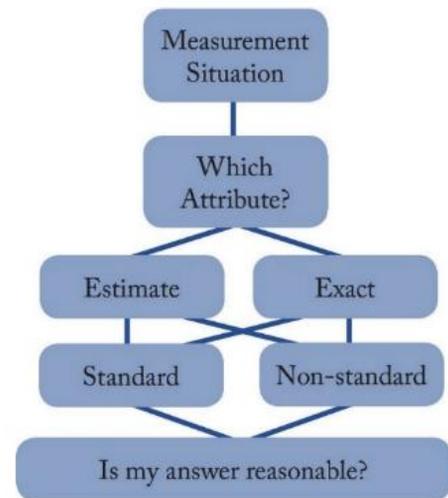
When deciding which unit to use to solve a problem, sometimes we need to convert from one metric unit to another. For example, to calculate how many 300 x 150 mm tiles are needed for a bathroom measuring 3.5 x 3 m, we need to convert millimetres to metres, or convert the metres to millimetres. It helps to use the place value within the metric system to do these conversions.

To convert millimetres to metres we divide by 1000.

$$300 \text{ mm} = 0.3 \text{ m}$$

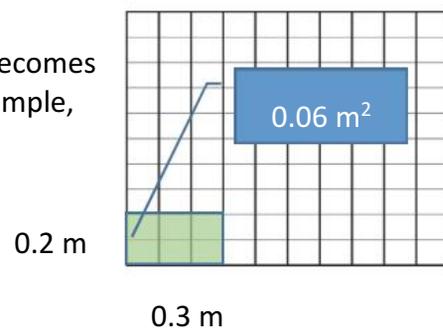
To convert metres to millimetres we multiply by 1000.

$$3 \text{ m} = 3000 \text{ mm}$$



Kilo-unit	Hecto-unit	Deca-unit	Base unit	Deci-unit	Centi-unit	Milli-unit
K	h	D		d	c	M
1000 units	100 units	10 units	1 unit	$\frac{1}{10}$ unit	$\frac{1}{100}$ unit	$\frac{1}{1000}$ unit

Solving problems which involve converting between units becomes more complex when area and volume are involved. For example, an area of 200 mm x 300 mm = 600 mm². However when converted to metres, an area of 0.2 m x 0.3 m = 0.06m². It helps to draw a diagram to understand the numbers within the conversion.



Whole Class Activity 1

Scenario: Anna is training to be an enrolled nurse and is learning how to chart the weight of a baby as it grows. She needs to know if the baby is growing at a healthy rate. To do this, she graphs the baby's weight over time and compares it with a graph showing normal weight gain in healthy babies from the World Health Organisation.

http://www.who.int/childgrowth/standards/cht_wfa_girls_p_0_6.pdf?ua=1

Anna recorded the weight of Lila, a baby girl, from birth to 6 months old.

Age	Weight
Birth	3405 g
3 weeks	4 kg and 65 g
6 weeks	4582 g
10 weeks	5.7 kg
3 and a half months	6.82 kg
5 months	8 kg 400 g

Work through this scenario using the decision making process. First, identify the problem using the key information. It helps to know what attribute you are focussing on, length, mass, capacity, area or volume, and what unit to use, metres, litres, grams, etc.

List the steps you will take to solve the problem below. Set up your own problem solving table if necessary, and then solve the problem.

Reflect on your answer – does it make sense?

Reflection and Discussion

Describe the level of accuracy required for this scenario and justify why you have described it this way.



What metric relationships did you have to use when solving this scenario?



Did you use a formula to calculate? Why? Why not?



Did you need to revise your thinking after asking yourself 'Is my Answer Reasonable?' Which sections and why? Share your thinking with others.



Draw a decision making flow diagram below to show the steps you took to solve this problem.

Skills Practice 1

1. Convert these mass measurements.

- | | | | |
|---------------|----|----------------|----|
| a) 400 g = | kg | g) 150.3 kg = | g |
| b) 1045 g = | kg | h) 128 kg = | t |
| c) 5 g = | kg | i) 1 230 kg = | t |
| d) 23 520 g = | kg | j) 10 150 kg = | t |
| e) 9 kg = | g | k) 3.2 t = | kg |
| f) 12.5 kg = | g | l) 15.85 t = | kg |

2. In each pair circle the largest measurement.

- | | | | | | |
|-----------|----|--------|-----------|----|-----------|
| a) 1525 g | or | 15 kg | e) 103 kg | or | 1 300 g |
| b) 120 kg | or | 1.2 t | f) 10.8 t | or | 1 8001 kg |
| c) 7.3 t | or | 730 kg | g) 345 g | or | 3.45 kg |
| d) 899 g | or | 0.8 t | h) 250 kg | or | 2.5 t |

Small Group Activities

Work through the following small group activities with one or two classmates, using the decision making process as a guide.

First, clarify the problem using the key information. It helps to know what attribute you are using, length, mass, capacity, area or volume.

Then list the steps you will take to solve the problem. Set up your own problem solving table if necessary, and then solve the problem.

Reflect on your answer – does it make sense?

After solving each problem, draw a decision making flow diagram to show the steps your group took to solve the problem.

Small Group Activity 1

Scenario: The Department of Parks and Wildlife is preparing to carry out a prescribed burn in an area of Dwellingup State Forest.

This is a map of the area that will be burned.

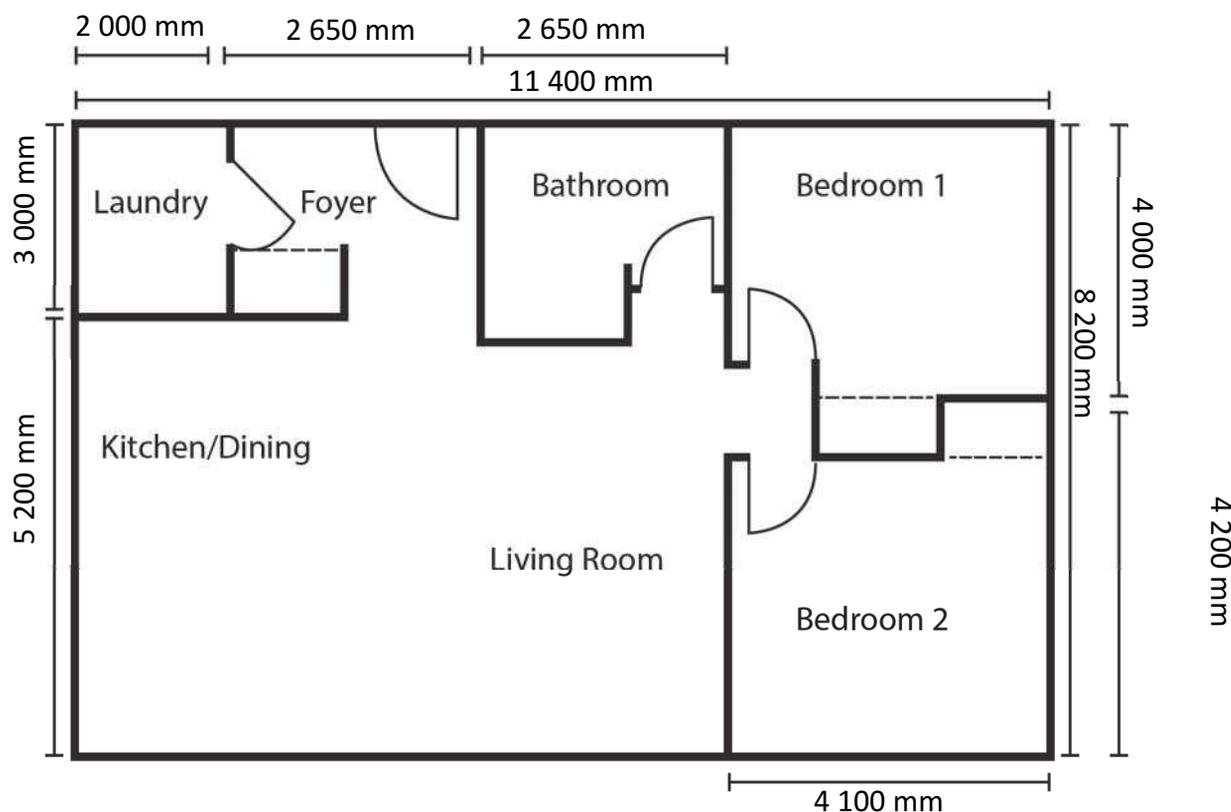


How many hectares of land will be burned?

How big is the perimeter of the burn?

Small Group Activity 2

Scenario: You have inherited your grandmother's house and decide to put down new carpet in the bedrooms. Go online to find out the steps you need to take to lay your own carpet. For example, use <https://www.youtube.com/watch?v=UhjTecUYPVc>



The carpet is 3.66 m wide. The carpet store recommends adding 10% to the total amount to allow for wastage, joining and trimming. How much carpet should you order from the shop?

When the carpet is installed it is placed in the room, attached to the edge and trimmed 10 mm from the wall.

How much carpet is needed for the bedrooms? The carpet costs \$45 per m². How much will it cost?

Small Group Activity 3

Scenario: Tilly and her family live on a property that is not connected to mains water. They collect rainwater in a tank which they use for all household needs. The water is collected from the roof. To calculate the amount of water that can be harvested use this formula **area of the roof (m²) x amount of rainfall (mm) per year = litres**

Tilly lives in an area where the rainfall each year is approximately 685 mm.

The area of the roof is 135 m².

One 110 kilolitre tank for household needs and one 20 000 litre tank for fire safety are on the property.

If the tank runs out of water, they have to buy the water at a cost of \$193 per 1.4 kilolitres.

Will a year of average rainfall fill the tanks or will Tilly's family need to top up the tanks with purchased water?

If the tank used for household needs is filled, how much water is the household able to use each week?

Reflection and Discussion

How accurate did you need to be in each of these scenarios? Did this affect your choice of unit?



What units did you need to convert to make to solve each of these problems?



What strategies did you use to complete these conversions?



Look at the decision making diagrams you have drawn. How are they different from the one on page 176? How are they the same?



Skills Practice 2

1. Convert these area measurements.

a) $800 \text{ mm}^2 =$ cm^2

b) $2\,340 \text{ mm}^2 =$ m^2

c) $23\,000 \text{ m}^2 =$ ha

d) $530 \text{ cm}^2 =$ mm^2

e) $5 \text{ m}^2 =$ mm^2

f) $6 \text{ km}^2 =$ m^2

g) $134 \text{ m}^2 =$ mm^2

h) $8 \text{ ha} =$ m^2

i) $345\,000 \text{ m}^2 =$ km^2

j) $78 \text{ km}^2 =$ ha

2. Convert these length measurements.

- | | | | |
|---------------|----|-------------|----|
| a) 8 000 mm = | m | f) 5.6 km = | m |
| b) 5.3 m = | mm | g) 48 cm = | m |
| c) 47 600 m = | km | h) 82 km = | m |
| d) 782 cm = | mm | i) 9 m = | mm |
| e) 103 km = | m | j) 620 cm = | mm |

3. Convert these capacity measurements.

- | | | | |
|--------------|----|--------------|----|
| a) 8 230 L = | kL | e) 50 ml = | L |
| b) 74 mL = | L | f) 4 672 l = | kL |
| c) 6.9 kL = | L | g) 580 kl = | L |
| d) 7.2 L = | mL | h) 2.6 l = | mL |

4. In each pair, circle the largest measurement.

- | | | | | | |
|-------------|----|--------|-------------------------|----|------------------------|
| a) 3 L | or | 300 mL | e) 8 950 kg | or | 89.5 t |
| b) 3 250 mL | or | 32.5 L | f) 2.4 ha | or | 240 m ² |
| c) 8.7 kL | or | 8070 L | g) 3 480 m ² | or | 34.8 km ² |
| d) 901 g | or | 9.1 kg | h) 99 m ² | or | 99 000 cm ² |

Individual Activities

Work through the following activities by yourself using the decision making flow diagrams you have drawn above and the one on page 176 as a guide.

First, clarify the problem using the key information. Then list the steps you will take to solve the problem. If you need to, draw your own problem solving table.

Reflect on your answer – does it make sense?

After solving each problem, draw a decision making flow diagram to show the steps you took to solve the problem.

Individual Activity 1

Scenario: Sue is planning to build some raised vegetable garden beds in her backyard. She has a space that is 9 m x 6 m to build them in. The beds will be 400 mm high.

Each garden bed needs to be filled with soil mix and have sprinklers along the edge.

Create a plan on some grid paper to show the size and position of the garden beds.

The plan must show the measurements of the beds.

You also need to provide details on the amount of soil needed to fill the beds and the amount of pipe needed for the sprinkler system for each bed.

Sue has a dog, so will need to put a fence around the garden to keep the dog out. Work out how much fencing Sue needs to purchase.

Individual Activity 2

Scenario: Troy has a small business selling homemade skincare products.

His bestseller is a moisturiser for men, so he is making up a large batch of it. He needs to make 20 tubs. Each tub holds 150 g of moisturiser.

This is the recipe:

80% water	2% xanthan gum powder
9% macadamia oil	4% emulsifying wax
1% fragrance oil	4% aloe vera gel
1% preservative – on top of 100% mixture amount	

The amounts need to be weighed.

How much of each ingredient will Troy need to make this batch of moisturiser?

Individual Activity 3

Scenario: Kira is a mural artist and has been commissioned to create a mural for a café wall that is 4.1 m wide and 2.3 m tall.

She creates her mural design on a sheet of A3 paper using cm measurements.

What scale should Kira use to create her design on the A3 paper so it can easily be scaled up to fit on the café wall?

Draw a diagram showing the measurements of the A3 sized picture and show the scale you used.

Kira then draws a grid of squares over the design so it can be easily scaled up.

When Kira is ready to paint the mural onto the wall, she creates a grid of squares on the wall and copies the image in each square from the design to the wall.

This video shows the process that Kira uses to transfer the mural design to the wall.

<https://www.youtube.com/watch?v=jMB1nAmgn1A>

How big do the grid squares need to be on the original design and on the café wall?

Kira charges clients a \$249 per square metre of mural. This amount covers Kira's paint costs and time.

How much will this mural cost the client?

The wall must be painted with 1 coat of primer paint before the mural design is added. One litre of primer covers 16 m^2 . How much primer will Kira need?

Kira gets another commission for a wall that is 4.5 m by 8.2 m. How can she quickly estimate the cost of the job?

Create a spreadsheet for Kira so she can give clients estimates quickly.

Reflection and Discussion

How accurate did you need to be in each of these scenarios? Did this affect your choice of unit?



What units did you need to convert to solve each of these problems?



What strategies did you use to complete these conversions?



Look at the decision making diagrams you have drawn. How are they different from the one on page 176? How are they the same?



Reflection on Learning

What mathematics did you use in this topic? What strategies did you use?



What strategies did you use to check whether your answers were reasonable?



Which conversions did you find the easiest to complete?



Which calculations did you use the most?



Self-Assessment

Complete the following self-assessment to focus your attention on your own learning needs.

	What did you find easy?	What did you find hard?	What part do you still need to work on?
Mathematics Thinking Process			
Skills			

Answers

Section 1: Rates and Ratios

Topic 1: Rates

PRACTICE EXERCISE 1

- 1a) Rates: 72 km/h, 71 beats/minute, 25 mL/5L, 9.3 m/sec, \$17.89/kg, 2 tsp per 3 tbs, 8 sit-ups per 30 seconds, \$18/hr, \$1.41/L, \$32 per 100 g
 b) Petrol Prices-\$1.41/L; Pulse rate-71 beats/minute; Mixing herbicide-25 mL/5L, Average Speed-72 km/h; Recipes-2 tsp per 3 tbs; Wages-\$18/hr; Exercising-8 sit-ups per 30 seconds; Food prices-\$32 per 100 g or \$17.89/kg.
 2a) Answers provided. Answers may vary in Question 2. If they do, check with your teacher
 b) 1. Grams, 2. Square metre; grams per square metre
 c) 1. Percentage, 2. Year; Percentage per year or per annum
 d) 1. Dollars, 2. Square Metre; Dollars per square metre
 e) 1. Millimetres, 2. Day/Week/Month; Millimetres per week
 f) 1. Dollars, 2. Week; Dollars per week
 3 RATES PROBLEMS; a, b, c, e, f
 RATES AS AN ANSWER; b, e, f

PRACTICE EXERCISE 2

- 1a) Answers provided
 b) $\$450 \times 52 = \$23\ 400$; Dollars per week \times Number of weeks = Rent paid in a year.
 c) $50\text{ mL} \times 7\text{L} = 350\text{ mL}$; Millilitres per Litre \times Number of Litres = Amount of cordial.
 d) $75\text{ km/h} \times 2\text{ hours} = 150\text{ km}$; Kilometres per hour = Number of Hours \times Amount of Number of kilometres
 e) $8\text{ laps/h} \times 0.5\text{ hours} = 4\text{ laps}$; Laps per hour Number of Hours = Number of Laps

PRACTICE EXERCISE 3

- 1a) Exact; calculator;

1 Litre	\$1.32
?Litres	\$55.65

 Division; $55.65 \div 1.32 = ?$; 42.16 L;
 It is reasonable.
 42.16L would cost \$55.65,
 42.16 refers to the number of Litres
 b) 1a) Exact; Mental

1 hour	? \$
30 hours	\$600

 Division; $600 \div 30 = ?$; 20;
 It is reasonable.
 \$20/hour for 30 hours would pay \$600.
 \$20 refers to the wage per hour.

- c) Approximate; mental;

1 Kg	\$15
?kg	\$60

 Division; $60 \div 15 = ?$; 4 kg;
 It is reasonable.
 4 kg would cost \$60,
 4 refers to the number of kilograms

- d) Exact; mental;

1 Litre	75 mL
9 Litres	mL

 Multiplication; $9 \times 75 = ?$; 675 mL;
 It is reasonable.
 675 mL would be added to 9L,
 675 refers to the number of millilitres

- e) Exact; calculator;

1 Hour	85 km
? Hours	552.5 km

 Division; $552.5 \div 85 = ?$; 6.5 hours;
 It is reasonable.
 It would take 6.5 hours to drive
 552.5 km,
 6.5 refers to the number of hours

- f) Exact; mental;

1 min	3 boxes
60 mins	? boxes

 Multiplication; $3 \times 60 = ?$; 180 boxes;
 It is reasonable.
 180 boxes in 1 hour on an assembly
 line, 180 refers to the number of boxes

2. circle b and d
 a) multiplication – total distance missing b) multiplication- total cordial missing c) division-total rupiah present d) division- total cost present

3.

MULTIPLICATION PROBLEMS	DIVISION PROBLEMS								
Problem: a Rate Table <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 Hour</td><td>25 km</td></tr> <tr><td>0.5 Hours</td><td>? km</td></tr> </table> Number Sentence $25 \times 0.5 = ?$ Strategy And Solution $25 \div 2 = 12.5$ Answer Written In Sentence Form: Ashley travels 12.5 km in half an hour	1 Hour	25 km	0.5 Hours	? km	Problem: c Rate Table <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>\$1</td><td>8 000 rupiah</td></tr> <tr><td>?</td><td>22 500 rupiah</td></tr> </table> Number Sentence $22\ 500 \div 8\ 000 = ?$ Strategy And Solution: Calculator; 2.8125; \$2.81 Answer Written In Sentence Form: 22 500 rupiah is worth \$2.81	\$1	8 000 rupiah	?	22 500 rupiah
1 Hour	25 km								
0.5 Hours	? km								
\$1	8 000 rupiah								
?	22 500 rupiah								
Problem: b, Approximate Rate Table <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 Litre</td><td>150 mL</td></tr> <tr><td>3 L</td><td>?</td></tr> </table> Number Sentence $150 \times 3 = ?$ Strategy And Solution: Double 150 $+150 = 450$ Answer Written In Sentence Form: About 150 mL of cordial is needed for 3.05L of water	1 Litre	150 mL	3 L	?	Problem: d, Approximate Rate Table <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 kg</td><td>\$40</td></tr> <tr><td>? kg</td><td>\$20</td></tr> </table> Number Sentence $1 \div 2 = ?$ Strategy And Solution: 0.5 Answer Written In Sentence Form: Terri cpid buy 0.5 kg of cherries	1 kg	\$40	? kg	\$20
1 Litre	150 mL								
3 L	?								
1 kg	\$40								
? kg	\$20								

4.

4 kg	7.25×4	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 kg</td><td>\$7.25</td></tr> <tr><td>4 kg</td><td>?</td></tr> </table> 4 times as many \$	1 kg	\$7.25	4 kg	?
1 kg	\$7.25					
4 kg	?					
$4\frac{3}{4}$ kg	7.25×4.75	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 kg</td><td>\$7.25</td></tr> <tr><td>4.75 kg</td><td>?</td></tr> </table> 4.75 times as many \$	1 kg	\$7.25	4.75 kg	?
1 kg	\$7.25					
4.75 kg	?					
1.25 kg	7.25×1.25	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 kg</td><td>\$7.25</td></tr> <tr><td>1.25 kg</td><td>?</td></tr> </table> 1.25 times as many \$	1 kg	\$7.25	1.25 kg	?
1 kg	\$7.25					
1.25 kg	?					
0.75 kg	7.25×0.75	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 kg</td><td>\$7.25</td></tr> <tr><td>0.75 kg</td><td>?</td></tr> </table> 0.75 times as many \$	1 kg	\$7.25	0.75 kg	?
1 kg	\$7.25					
0.75 kg	?					

5.

40kg	$500 \div 40$	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 kg</td><td>?</td></tr> <tr><td>40 kg</td><td>500</td></tr> </table> 40 times less \$	1 kg	?	40 kg	500
1 kg	?					
40 kg	500					
65 kg	$500 \div 65$	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 kg</td><td>?</td></tr> <tr><td>65 kg</td><td>500</td></tr> </table> 65 times less \$	1 kg	?	65 kg	500
1 kg	?					
65 kg	500					
$55\frac{3}{4}$ kg	$500 \div 55.75$	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 kg</td><td>?</td></tr> <tr><td>55.75 kg</td><td>500</td></tr> </table> 55.75 times less \$	1 kg	?	55.75 kg	500
1 kg	?					
55.75 kg	500					
80.625 kg	$500 \div 80.625$	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 kg</td><td>?</td></tr> <tr><td>80.625 kg</td><td>500</td></tr> </table> 80.625 times less \$	1 kg	?	80.625 kg	500
1 kg	?					
80.625 kg	500					

- 6a) $145 \div 75$ b) 60×0.5 c) $75 \div 0.75$ d) 75×0.75

7.

Luke Clark: Normal Rate \$25/hr				Briony Broom: Normal Rate \$7/hr			
	Hourly Rate	Hours	Wage		Hourly Rate	Hours	Wage
Mon – Fri	\$25	30	\$750	Mon – Fri	\$14	25	\$350
Sat	\$37.50	10	\$375	Sat	\$21	2	\$42
Sun	\$50	3	\$150	Sun	\$28	10	\$280
TOTAL WAGE			\$1275	TOTAL WAGE			\$672

- 8a) 125 L b) 300 L c) 170 minutes or 2 hours 50 mins d) 45 mins e) 180 L f) 141.6 minutes

PRACTICE EXERCISE 4

1.

RATE	RATE TABLE	NUMBER SENTENCE(S)	SOLUTION				
a) 160 km in 4 hours	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 hour</td><td>?</td></tr> <tr><td>4 hours</td><td>160 km</td></tr> </table>	1 hour	?	4 hours	160 km	$4 \times ? = 160$ $160 \div 4 = ?$	The unit rate is 40 km/h
1 hour	?						
4 hours	160 km						
b) \$45 for 3 hours work	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 hour</td><td>?</td></tr> <tr><td>3 hours</td><td>\$45</td></tr> </table>	1 hour	?	3 hours	\$45	$3 \times ? = 45$ $45 \div 3 = ?$	The unit rate is \$15/h
1 hour	?						
3 hours	\$45						
c) 78 words per 2 minutes	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 min</td><td>?</td></tr> <tr><td>2 mins</td><td>78 words</td></tr> </table>	1 min	?	2 mins	78 words	$2 \times ? = 78$ $78 \div 2 = ?$	The unit rate is 39 words/min
1 min	?						
2 mins	78 words						
d) 80 km ² for 40 people	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 person</td><td>?</td></tr> <tr><td>40 ppl</td><td>80 km²</td></tr> </table>	1 person	?	40 ppl	80 km ²	$40 \times ? = 80$ $80 \div 40 = ?$	The unit rate is 2 km ² /per
1 person	?						
40 ppl	80 km ²						
e) 15 000 revs in 2.8 mins	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 min</td><td>?</td></tr> <tr><td>2.8mins</td><td>15 000 revs</td></tr> </table>	1 min	?	2.8mins	15 000 revs	$2.8 \times ? = 15000$ $15000 \div 2.8 = ?$	The unit rate is 357 revs/min
1 min	?						
2.8mins	15 000 revs						
f) 156 beats in 1 and a half minutes	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>1 min</td><td>?</td></tr> <tr><td>1.5 mins</td><td>156 beats</td></tr> </table>	1 min	?	1.5 mins	156 beats	$1.5 \times ? = 156$ $156 \div 1.5 = ?$	The unit rate is 104 beats/min
1 min	?						
1.5 mins	156 beats						

2. Nyung B: 32 km/h
 3a) \$2.47, b) 804 beats, c) \$75. d) \$68.20, e) \$17.15,
 f) 135 grams
 4a) the car consumes 6.2 L of petrol every 100 km
 b) It would be 0.062 L per km and this could be confusing. People are more used to whole numbers.
 c) 12.4 L, d) 20.15 L, e) 322.06 L, f) Thomas' car

PRACTICE EXERCISE 5

1. Shop C; \$11.85/kg
 2. Penny; \$1.41/L
 3a) Ormonds \$17.99/24 cans; Rays \$14.99/18 cans. Write the price of cola at each supermarket as a rate.
 b) Ormonds \$0.75/can; Rays \$0.83/can
 c) Ormonds
 4a) \$3.60/2kg; \$5.10/3kg, b) \$1.80/kg; \$1.70/kg, c) The 3 kg bag

REFLECTION ON LEARNING

- 1a) \$9/kg, b) The 750 g size, c) 277.78 mins, d) 32.5 hours,
 e) Doesn't involve rates, f) \$9.62/week, g) 33.6 L, h) 225 km
 2a) It costs \$9 for each kg of pears, b) The larger tub is the cheaper,
 c) The number of minutes it takes to type those words,
 d) The total hours worked by Nikita, e) Doesn't involve rates,
 f) She pays \$9.62 for each week of a year, g) The total number of Litres used in 350 km, h) The total distance driven in the time

OLNA PRACTICE EXAMPLES

1. B 2. B

Topic 2: Ratios

PRACTICE EXERCISE 1

1. A, D and E
 2.

Part-to-part Ratio	Part-to-whole Ratio	Fraction	Percentage
5:2	5:7 and 2:7	$\frac{5}{7} + \frac{2}{7}$	71% + 29% (rounded)
1:2:1	1:4 and 2:4 and 1:4	$\frac{1}{4} + \frac{2}{4} + \frac{1}{4}$	25% + 50% + 25%
3:9	3:12 and 9:12	$\frac{3}{12} + \frac{9}{12}$	25% + 75%

3. a) Answers will vary. Check with your teacher or classmates. b) 3:1, 3:4 and 1:4. With all three ratios the 3 refers to the powder and the 1 refers to the water. c) $\frac{3}{4}$, $\frac{1}{4}$. The denominator is the total number of parts in the mixture. The numerators are the number of parts for powder and water. d) 75% and 25%

4. a)

	Sawdust	Sand	Peat	Whole
Ratio	2	2	1	5
Fraction	$\frac{2}{5}$	$\frac{2}{5}$	$\frac{1}{5}$	$\frac{5}{5}$
Percentage	40%	40%	20%	100%

PRACTICE EXERCISE 2

1. a) part-to-part ratio
 b)

Pie Dough Ratio				
Weight of 1 part	Flour	Butter	Water	Weight of Mixture
100 g	3 x 100 g = 300 g	2 x 100 g = 200 g	1 x 100 g = 100 g	600 g
50 g	3 x 50 g = 150 g	2 x 50 g = 100 g	1 x 50 g = 50 g	300 g
120 g	3 x 120 g = 360 g	2 x 120 g = 240 g	1 x 120 g = 120 g	720 g

2. a) 1:2 b) $\frac{1}{3}$ c) 200 ml of developer, 300 ml of mixture. d) 200 ml of colour and 400 ml of developer.
 3.

Tropical Juice Ratio			
Size	Coconut	Pineapple	Guava
Regular	50 ml	100 ml	100 ml
Medium	80 ml	160 ml	160 ml
Large	150 ml	300 ml	300 ml

PRACTICE EXERCISE 3

1. a)

Sugar	Flour	Butter	Egg	Chocolate
400 g	250 g	200 g	200 g	150 g

- b) The ratio of ingredients stays the same but the quantity of each is doubled.
 c) 800 g chocolate, 500 g of flour, 400 g of butter, 400 g of egg and 300 g of chocolate.

2. a) the amount of men must be a multiple of 4 and the number of women must be a multiple of 7, and they must be in the same proportion to each other.
 b) 35
 c) 24 men and 42 women
 d) 1:1

Men	Women
4	7
8	14
12	21
16	28
20	35

3. a) 1:20 000 means that every unit on the map is 20 000 units in real life. b) Measure distances on the map with a ruler and then multiply that amount by 20 000, c) 1.4 km d) 1.6 km
 e) 1.2 km²

4. a) 1:20 means that for every unit of length in real life the pictures on the plan will be 20 times smaller. b) Divide each measurement by 20. c) fridge = 40 mm x 35 mm, oven = 30 mm x 30 mm, sink = 43 mm x 22 mm, pantry = 40 mm x 20 mm, island bench = 45 mm x 125 mm. d) Answers will vary. Check with your teacher or classmates.

5. a) 3:12 b) 2:9 c) 3:7 d) 6:9 e) 5:4 f) 4:3 g) 3:1:5 h) 4:2:5

PRACTICE EXERCISE 4

1. a) 1:2:9 b) 1:2:4 c) 1:1:6 d) M2 mortar and the top coat of render use the same proportion of sand which is 75%.
 e) the floor slab has the largest proportion of cement, it is $\frac{1}{7}$

PRACTICE EXERCISE 5

1. A = $\frac{1}{100\,000}$, D = $\frac{1}{3}$ and E = $\frac{1}{3}$
 2. a) 50 parts fuel to 2 $\frac{1}{2}$ parts oil, b) 2 men to 7 women,
 c) 1 part juice concentrate to 4 parts water d) 2 parts disinfectant to 30 parts water.

REFLECTION ON LEARNING

1. a) Exact; Calculator or Mental; Multiplication; 100 x 19 = ?; 1900 ml of water is required, b) Exact; Mental; Multiplication; 1 x 4 = ?, 2 x 4 = ?, 1 x 4 = ?; 4 cups of chocolate chips, 8 cups of flour and 4 cups of sugar. c) Exact; Mental or Calculator; Division and Multiplication; 140 ÷ 7 = 20, 20 x 2 = 40, 20 x 5 = 100; 40 people did not like the movie.

OLNA PRACTICE EXAMPLE

1. A, 2. C

Section 4.2: Statistics and Probability

Topic 1: Probability

PRACTICE EXERCISE 1

1. Impossible-iii; Unlikely-ii; Even Chance; Likely-i, iv, vi; Certain-v
 a) v; b) iii; c) iv
 2a) Impossible; b) Highly likely; c) Highly unlikely; d) Even chance
 e) Certain; f) Unlikely
 3. a, c, f, d, b, e
 4a) All 10 marbles would be red; b) There would be at least 7 red marbles. c) There would be 2, 3 or 4 red marbles;
 d) If there were only red and blue marbles there could be 1-4 red marbles. If there were a mix of colours, there could be 0-4 red as long as it was less than blue; e) 5 red marbles; f) 2 red and 1 blue with other colours, 4 red and 2 blue with other colours or 6 red and

- 3 blue with one other colour
5. C and D (could be the same), E, F, B, A

PRACTICE EXERCISE 2

1. Answers may vary. Check with your teacher



A - $\frac{1}{2}$; B - $\frac{95}{100}$; C - $\frac{5}{6}$; D - $\frac{1}{6}$; E - $\frac{1}{3}$; F - $\frac{2}{3}$

2. Answers may vary. Check with your teacher.



A. 100%, B. 10%, C. 0%, D. 25%, E. 33%

3. Some answers may vary. Check with your teacher.

a) 0.5, b) 0.9, c) 0.25, d) 1.0, e) 0.25, f) 0.00001

4.

Bag Contains:	Word Description	Number
Many blue marbles and two red marbles	highly likely	85%
No blue marbles	Impossible	0
The same number of blue as red marbles and no other coloured marbles	fifty-fifty	50%
One blue marble and 99 red marbles	highly unlikely	$\frac{1}{100}$
Twice as many red marbles as blue and no other marbles	unlikely	0.3333333
All blue marbles	Certainty	1

PRACTICE EXERCISE 3

1a) $\frac{1}{6}$; b) $\frac{1}{6}$; c) $\frac{1}{2}$; d) $\frac{1}{3}$; e) 0; f) $\frac{5}{6}$

2a) HH, TT, HT, TH

b)



c) Write the probability of each event occurring as a fraction, decimal and percentage.

Event	Fraction	Decimal	Percentage
A	$\frac{1}{4}$	0.25	25%
B	$\frac{1}{2}$	0.5	50%
C	$\frac{3}{4}$	0.75	75%
D	0	0	0%

d) D, A, B, C, D.

3. A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z.

a) $\frac{1}{26}$ b) $\frac{21}{26}$ c) $\frac{1}{13}$ d) $\frac{5}{26}$ e) $\frac{5}{26}$ f) $\frac{21}{26}$

4 a)

HEARTS	ACE	2	3	4	5	6	7	8	9	10	JACK	QUEEN	KING
DIAMONDS	ACE	2	3	4	5	6	7	8	9	10	JACK	QUEEN	KING
CLUBS	ACE	2	3	4	5	6	7	8	9	10	JACK	QUEEN	KING
SPADES	ACE	2	3	4	5	6	7	8	9	10	JACK	QUEEN	KING

b) $\frac{1}{2}$; c) $\frac{1}{13}$; d) $\frac{1}{13}$; e) $\frac{10}{13}$; f) $\frac{3}{13}$

5a) $\frac{1}{6}$; b) 0; c) $\frac{1}{3}$; d) 1; e) $\frac{1}{3}$; f) $\frac{2}{3}$

PRACTICE EXERCISE 4

1a) Not equally likely. More chance of landing on its side

b) – l) Answers may vary. Check with your teacher or a classmate.

2a) They are not equally likely to occur. You are more likely to get blue as blue covers the largest area in the spinner

b) (i) no (ii) no (iii) no, c) No, nearly impossible

d) Yes but highly unlikely, e) 75, f) Not equally likely. More likely to land on red as it covers a larger area of the spinner

g) (i) no (ii) no (iii) no, h) Yes but unlikely, i) Yes but highly unlikely

j) 625 (answers may vary but should be close to this number)

3a) $\frac{1}{45}$ b) $\frac{41}{45}$, c) 66 or 67, d) Answers will vary depending on when website is viewed, e) No. All numbers are equally likely, f) Answers will vary depending on when website is viewed g) $\frac{1}{45}$ h) iii, i) They all have the same chance of winning

4a) 17.5% b) 175 c) 12.8%, 1 536 people d) Answers will vary but predictions should be between 8-11% and the number of people out of 1 500 will vary depending on this prediction

REFLECTION ON LEARNING

EVENT	PROBABILITY	OCCURENCES IN 1000
A	0.8	800
B	$\frac{6}{30}$	200
C	$\frac{3}{4}$	750
D	90%	900
E	25%	250
F	16.66%	167
G	0.5	500
H	0.0000000001	0.00000001

OLNA PRACTICE EXAMPLES

1. C 2. D

Topic 2: Statistics 1

PRACTICE EXERCISE I

1. categorical data – a, e, numerical data – b, c, d, f, 2.a, b, e

3. Answers will vary. Check with your teacher or a classmate

4. Answers may vary but could include: Do you have a phone? Is it an iphone? What type of phone do you have?

PRACTICE EXERCISE 2

1.a – d Answers will vary. Check with your teacher or a classmate,

e) A dot or bar graph is the most suitable

2a) Column or bar graph. b) Table and then column, bar or pie graph.

c) Table and then Venn Diagram. d) Multiple column graph.

e) Pie graph or bar/column graph. f) Bar or column graph.

3a) Check your graph with your teacher

b) A line graph is best as it shows the weight changing continuously over time

4. A table followed by a pie chart or bar/column graph would be the best way of representing this data

PRACTICE EXERCISE 3

1a) It was collected directly by Angela

b)

TEAM	No OF SUPPORTERS
Geelong	1
Carlton	1
Collingwood	2
Hawthorn	2
Dockers	7
West Coast Eagles	2
St Kilda	3
Port Adelaide	1
Adelaide	1

c) Dockers, d) Geelong, Carlton, Port Adelaide, Adelaide, e) $\frac{1}{10}$

f) St Kilda

2a)

AMOUNT OF MONEY	NUMBER OF DONATIONS
10c	2
20c	4
50c	6
\$1	8
\$2	5
\$5	4
\$10	3
\$20	0
\$50	1

- b) $\frac{1}{33}$, c) 18.18%, d) \$1, e) \$1, f) \$3.70
 3. Answers will vary. Check your answers with your teacher and classmates.
 4. Answers will vary. Check your answers with your teacher and classmates.
 5. Answers will vary. Check your answers with your teacher and classmates.
 6. It does not make sense to calculate the median as this is categorical data. The mode is valid (i.e. most popular phone). The mean can be calculated to find the average number of phones in each category but this has little value.

PRACTICE EXERCISE 4

- 1a,b,c - Answers will vary. Check your answers with your teacher and classmates.
 2. Answers will vary. Check your answers with your teacher and classmates. The analysis will vary as this is categorical data and question 1 is concerned with numerical data.

REFLECTION ON LEARNING

Powerpoint. Check your answers with your teacher and classmates.

OLNA PRACTICE EXAMPLES

1. C 2. D

Topic 3: Statistics 2

PRACTICE EXERCISE I

1.

WEBSITE 1	WEBSITE 2
What is the purpose of the <i>TEAM</i> table? To show the progressive statistics, such as number of kicks, for each AFL team at any point in the season.	What is the purpose of the table for <i>PERTH</i> ? To show the climate statistics for Perth over 30 years.
What data is in each of the rows? The AFL team name	What data is in each of the rows? Temperature (maximum and minimum), Rainfall (maximum and minimum), Other daily conditions, 9 am and 3 pm conditions
What data is in each of the columns? Total number of kicks, handballs, inside 50's, marks etc.	What data is in each of the columns? The months and the overall annual averages.
Is this data a population or a sample? Population at this point in time; Sample of yearly statistics	Is this data a population or a sample? Population
How, when and where would the data have been collected? Would have been collected and recorded by statisticians during each game and afterwards by video to go onto this website ASAP	How, when and where would the data have been collected? Data recorded on a constant basis for each day in each month at Bureau of Meteorology sites across Perth

- 2a) Indigo and grey ,b) Blue and red, c) Grey, d) Orange, e) Blue
 f) No relationship as the students are randomly scattered over graph. We should not connect points as it is not taken over time nor is there a relationship.
 3. Brodie is correct. The graph shows the change in distance over time from home. It has nothing to do with height.
 4a) It is showing the types of vehicles that pass through the main street of Busselton.
 b) What type of vehicle was the (i) Sedans(ii) Station wagons
 c) True. The ute section of the graph is twice the area as that of the motorbike section

PRACTICE EXERCISE 2

- 1a) Column or Bar, b) Venn diagram, c) Circle graph, d) Line graph, e) Multiple column graph, f) Column graph
 2. A column graph is best as it allows easily visualised comparison between the bills.
 3a) The title, the labels on each of the axes, the age categories
 b) Ralph's histogram. Data that is continuous (ie 0-9 and 10 – 19 etc) should not have gaps between columns
 c) A line graph shows change over time and this data has no time. A column graph is best for categorical data and this data is continuous
 d) A column graph has gaps between columns a histogram does not.
 e) When the data is discrete (ie 8 year olds not the category 0 to 9)

PRACTICE EXERCISE 3

- 1a) 425 042 b) Wednesday c) $\frac{105438}{425042}$ d) 53 130.25 rounded to 53
 130 e) 87 602 f) Answers will vary. Check with your teacher and classmates.
 2a) 18 b) 164 cm. Has the most dots c) 163 cm. Can cross off highest with lowest and work inward to find median score
 d) 162.8333. It was calculated by $(2 \times 159 + 2 \times 160 + 2 \times 162 + 4 \times 163 + 5 \times 164 + 2 \times 165 + 167) \div 18$
 e) $167 - 159 = 8$ cm f) Answers will vary. Check with your teacher and classmates.
 3a) $\frac{243}{400}$ b) 35.75% c) $\frac{386}{400}$ d) 12 e) Students who did both casual work and were students f) 2

PRACTICE EXERCISE 4

- Answers will vary. Check with your teacher or classmates that interpretations involve reading the data, between the data and beyond the data
 2 a) Answers will vary. Check with your teacher or classmates
 b) Answers will vary. Check with your teacher or classmates
 c) Answers will vary. Check with your teacher or classmates but may include: the older members of the family not being able to attend. Thus the new oldest members would be in their 60's. Perhaps no family members in the 0-9 category.
 d) A multiple histogram with boys and girls represented by two different colours
 3a) All dot points involved *Reading the Data* and *Reading Between the Data*. There were no interpretations about *Reading Beyond the Data*
 1. Assaults continue to represent the majority of recorded violent crimes. The overall trend since 1996 has been upward, with an increase of 55 percent between 1996 and 2007.
 2. The trend in sexual assault has also followed a general increase. The highest numbers of victims of sexual assault and of assault were recorded in 2007.
 3. There were 282 victims of homicide in 2007: a 12 percent decrease from 2006 and the lowest number recorded in the past 12 years.
 4. Continuing the trend since 2004, robbery offences increased again in 2007, to 17,988.
 5. The number of recorded kidnappings fluctuates from year to year. From 1996 to 2004, kidnappings registered a general increase, but the number of victims of kidnapping has remained relatively steady following a decline in 2005.
 b) Answers will vary. Check with your teacher or classmates
 4a) People didn't live that long in 1901
 b) In 1956 the largest group of females were in the 0-4 category. This was almost the case in 1901 but definitely not in 2006.
 c) These people would have been born in 1932-1936 which was in WW1 when lots of young men and women would have been in Europe.
 d) There would be more older Australians and less younger

PRACTICE EXERCISE 5

- 1a) No vertical scale. Some columns in muted colours, one in dark. The graph is presented at an angle
 b) Kawasaki is darker so as to stand out and is toward the bottom of the graph making it look bigger
 c) Make graph horizontal and put in a vertical scale.
 2. Because it only shows the months July to Dec where of course the temperatures are increasing in Perth as the season changes from winter through to summer
 3a) mean - \$42 000 ; mode – \$27 000; median - \$28 000; range - \$71 000
 b) mean - \$28 000 ; mode – \$27 000; median - \$27 500; range - \$3 000
 c) The average salary is not true. The manager's salary inflated the overall average salary
 4a) This is misleading as the sample size of 10 is too small. He needs to trial around 50 to make a more accurate conclusion
 b) This is misleading as if people have been to a football game, obviously they like that sport. The location made the survey biased.

c) This is misleading as we don't know the size of the sample or where and when it was taken

REFLECTION ON LEARNING

Check your report with your teacher and classmates

OLNA PRACTICE EXAMPLES

1. A 2. D

Section 4.3: Application of the Mathematical Thinking Process

Topic 1: Numeration and Operations: Whole Numbers and Money

SKILLS PRACTICE 1

- 1a) 58 b) \$138 c) 43 d) \$169 e) 782 f) 95
2a) \$740 b) \$135 c) 52 d) \$575 e) 123 000 f) 4

SKILLS PRACTICE 2

- 1a) 70 b) \$288 c) 55 d) 87 e) 30 000 f) 12 500
2a) \$2 150 b) 1 800 c) 3 100 d) \$70 e) 9 000 f) \$2 400
3a) 6 b) 10 c) 74 d) 63 e) 91 000 f) 550
4a) 61, 60, 59, 58, 57, 56, b) 134, 143, 314, 341, 413, 431
c) 2 345, 2 354, 2 434, 2 435, 2 534, 2 543
d) 1 120, 1 201, 2 101, 11 002, 11 200, 12 110
e) 45 008, 45 068, 45 608, 45 806, 54 680, 64 580
f) 879 004, 878 409, 878 904, 879 094, 879 409, 897 004.
5a) Packs of 50. The total for these over the week was the highest.
b) Cell number will vary. Eg '=C3*50'
c) Answers will vary. Discuss with your teacher and classmates
d) Answers will vary. Discuss with your teacher and classmates
e) Pie or column graph, f) Column graph

SKILLS PRACTICE 3

- 1a) 58, b) 1 900, c) 7 005, d) 10, e) 2 050, f) 31

SKILLS PRACTICE 4

- 1a) Calculator \$250.32 b) Mental 800 c) Mental 3 500
d) Calculator 401.44 e) Mental 1 890 f) Mental \$75 . Strategy may vary depending on your mental skills.

SKILLS PRACTICE 5

- 1a) 25, b) 480, c) \$196, d) 2 180, e) 7 200, f) 200

Topic 2: Numeration and Operations: Fractions, Decimals and Percentages

SKILLS PRACTICE 1

1. a) \$22, b) \$32, c) \$13.50, d) 100, e) 540, f) 26 450
2. a) \$30, b) \$20.50, c) \$30.60, d) \$600, e) 90 300, f) 220 000
3. a) \$17.40, b) 1187.50, c) \$592.50, d) \$672.52, e) \$2921.60
f) \$4.76
4. a) \$916.80, b) \$16 410, c) \$37 650, d) 323.4, e) 1857.6,
f) 3795

SKILLS PRACTICE 2

1. a) 22.5, b) 57, c) 224, d) 918, e) 244.5, f) 1815
2. a) $\frac{4}{8}$, b) \$98, c) 114, d) $\frac{5}{16}$, e) \$5666.67, f) \$3967.50

SKILLS PRACTICE 3

1. a) \$187.35, b) \$403.90, c) \$4764.80, d) 2254.5, e) \$5061
f) 13757.04
2. a) \$1439.20, b) 14 600, c) \$205 per week and \$10 660 per year,
d) \$335.33, e) 1.69 kg, f) \$8.80

Topic 3: Time and Location

SKILLS PRACTICE 1

1. a) Ten past four b) Quarter past eight



- c) Five minutes to three, d) Twenty-three minutes past eleven



- 2a) 10:05 or 5 past 10 b) 12:51 or 9 minutes to one



- 3a) 3 hours, b) 1 hour and 5 mins or 65 mins,
c) 4 hours and 15 mins or 255 mins, d) 23 mins, e) 41 mins,
f) 1 hour and 20 mins or 80 mins
4a) 8:20 pm, b) 7:15 am, c) 4:05 pm, d) 3:45 pm, e) 10:48 am,
f) 8:15 am
5a) 25 mins, b) 13 mins, c) 5:35 pm, d) 8:16 pm, e) 37 mins
f) 6:11 pm

SKILLS PRACTICE 2

- 1a) 1020 hours, b) 0130 hours, c) 1200 hours, d) 1315 hours,
e) 1656 hours, f) 2024 hours
2a) 4 hours, b) 3 hours and 15 mins, c) 2 hours and 5 mins,
d) 35 mins, e) 2 hours and 35 mins, f) 3 hours and 30 mins
3a) King St, b) East-West, c) North-West, d) Gingin Rd
e) Walker Ave, f) There are several routes but one is: Travel north-east on Sidney St and take the first left into Boatoos St. This changes into Beacon Rd. Look for the sand dunes on the right hand side.
4a) Walk NW along South Tce. Take the first left into Collie St, right into Marine Tce, left at the roundabout into Warden Lane and the right into Mews Rd, Bathers Beach. 9 mins
b) Drive SE and then veer NE along th Northampton Wiligul Rd for 20 mins
c) Cycle west along Jolimont Rd, over the William Barak Bridge. Turn slightly left onto Princes walk, turn right into Federation Square. 5 mins
d) Catch the 2:03 tram to Rundle Mall. It will arrive at 2:51, hence taking 48 mins.
5a) approx 2 km, b) approx. 1.5 km, c) approx. 1.1 km,
d) approx. 2.8 km, e) approx. 2.2 km, f) approx. 2.4 km,
6. Answers will vary. Check with your teacher and classmates.

SKILLS PRACTICE 3

- 1a) 1 hour and 10 mins, b) 3 hours and 45 mins, c) 2 hours,
d) 1 hour and 20 mins, e) 1 hour and 40 mins, f) 15 mins
2a) Coles, b) H10 and I10, c) 5 d) Riseley St, e) 7 f) Nort West,
g) South West, h) Go west along the North Link Mall; Go south at Dymmocks; west when you get to Dome in the middle of the Centre Court and north into the food court,
i) We cannot calculate the distance as this is a plan and does not have a scale
j) This is a plan. It is not drawn to scale and does not have a scale to calculate distance.

Topic 4: Measurement: Estimating and Calculating

SKILLS PRACTICE 1

1. a) 6640 mm, b) 1.34 m^2 , c) 24.96 m^2 , d) $38\,125 \text{ m}^2$
2. a) 15.96 m^2 , b) 10.125 m^2 , c) 12.96 m^2 , d) 0.8 km^2 ,
e) $3 \text{ m} \times 9 \text{ m}$, f) Any dimensions where one side is 3 or more metres
and the total area is more than 20 m^2

SKILLS PRACTICE 2

1. a) 116 m, b) 29.2 m, c) 6 km, d) 14040 mm
2. a) 6750 cm^3 , b) $15\,362\,160 \text{ mm}^3$, c) 2.744 m^3 , d) $33\,000 \text{ cm}^3$
3. a) perimeter, 2200 mm, b) perimeter, 12.4 m,
c) volume, 1.2 m^3 , d) perimeter, 18 700 mm,
e) volume, 31.5 m^3 , f) perimeter, 13.6 km

SKILLS PRACTICE 3

1. a) 32850 L, b) 300 L, c) 89280 mL, d) 19.6 L, e) 57 L,
f) 6 glasses

SKILLS PRACTICE 4

1. a) 888, b) 2760 g, c) 1780 t, d) 3.9 kg, e) 56, f) 22.5 kg

Topic 5: Measurement: Relationships Between Metric Units

SKILLS PRACTICE 1

1. a) 0.4 kg, b) 1.045 kg, c) 0.005 kg, d) 23.52 kg, e) 9000 g,
f) 12 500 g, g) 150300 g, h) 0.128 t, i) 1.23 t, j) 10.15 t,
k) 3200 kg, l) 15850 kg
2. a) 1525 g, b) 1.2 t, c) 7.3 t, d) 0.8 t, e) 103 kg, f) 1 8001 kg,
g) 3.45 kg, h) 2.5 t

SKILLS PRACTICE 2

1. a) 80 cm^2 , b) 234 m^2 , c) 2.3 ha, d) $5\,300 \text{ mm}^2$,
e) $5\,000 \text{ mm}^2$, f) $6\,000 \text{ m}^2$, g) $134\,000 \text{ mm}^2$, h) $8\,000 \text{ m}^2$
i) 345 km^2 , j) 7 800 ha
2. a) 800 m, b) 5300 mm, c) 47.6 km, d) 7 820 mm,
e) 103 000 m, f) 5 600 m, g) 0.48 m, h) 82 000 m, i) 9 000 mm
j) 6 200 mm
3. a) 8.23 kL, b) 0.074 L, c) 6 900 L, d) 7 200 mL, e) 0.05L,
f) 4.672 kL, g) 580 000 L, h) 2 600 mL
4. a) 3 L, b) 32.5 L, c) 8.7 kL, d) 9.1 kg, e) 89.5 t, f) 2.4 ha,
g) 34.8 km^2 , h) $99\,000 \text{ cm}^2$

